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United States
Department of
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Forest
Service

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Draft Environmental Impact Statement

East Fredericktown Project

Potosi/Fredericktown Ranger District, Mark Twain National Forest
Bollinger, Madison, St. Francois, and Ste. Genevieve Counties, Missouri

East Fredericktown Project
Draft Environmental Impact Statement
Bollinger, Madison, Ste. Genevieve, and St. Francois Counties, Missouri

Lead Agency: **USDA Forest Service**

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Abstract: The East Fredericktown Project DEIS documents the analysis of three alternatives developed as possible management strategies to emphasize the management of shortleaf pine in its natural range on sites where it is recognized as a dominant or characteristic member of the natural community and examine opportunities to minimize adverse impacts from insects and disease damage. The project is designed to restore shortleaf pine on sites where it was historically dominant, improve forest health, treat affected stands, recover valuable timber products, promote public safety, and move the area to the desired future condition. The environmental impacts of three alternatives are analyzed in detail. Alternative 1 proposes a combination of prescribed burning and cutting trees without commercial harvesting. Alternative 2 proposes differing combinations of commercial harvesting and prescribed burning. Alternative 3 displays expected results if no action is taken.

Reviewers should provide the Forest Service with their comments during the review period of the draft environmental impact statement. This will enable the Forest Service to analyze and respond to the comments at one time and to use information acquired in the preparation of the final environmental impact statement, thus avoiding undue delay in the decisionmaking process. Reviewers have an obligation to structure their participation in the National Environmental Policy Act process so that it is meaningful and alerts the agency to the reviewers' position and contentions. Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 553 (1978). Environmental objections that could have been raised at the draft stage may be waived if not raised until after completion of the final environmental impact statement. City of Angoon v. Hodel (9th Circuit, l986) and Wisconsin Heritages, Inc. v. Harris, 490 F. Supp. 1334, 1338 (E.D. Wis. 1980). Comments on the draft environmental impact statement should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

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Date Comments Must Be Received: September 20, 2004

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CHAPTER 1. PURPOSE OF AND NEED FOR ACTION

Document Structure

The Forest Service has prepared this Environmental Impact Statement in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This Environmental Impact Statement discloses the direct, indirect, and cumulative environmental impacts that would result from the proposed action and alternatives. The document is organized into four chapters:

Chapter 1. Purpose and Need for Action:
The chapter includes information on the history of the project proposal, the purpose of and need for the project, and the agency's proposal for achieving that purpose and need. This section also details how the Forest Service informed the public of the proposal and how the public responded.

Chapter 2. Alternatives, including the Proposed Action:
This chapter provides a more detailed description of the agency's proposed action as well as alternative methods for achieving the stated purpose. These alternatives were developed based on significant issues raised by the public and other agencies. This discussion also includes mitigation measures. Finally, this section provides a summary table of the environmental consequences associated with each alternative.

Chapter 3. Affected Environment and Environmental Consequences:
This chapter describes the environmental effects of implementing the proposed action and other alternatives. This analysis is organized by [insert topic (i.e., resource area, significant issues, environmental component)].

Chapter 4. Consultation and Coordination:
This chapter provides a list of preparers and agencies consulted during the development of the environmental impact statement.

Appendices:
The appendices provide more detailed information to support the analyses presented in the environmental impact statement.

Index: The index provides page numbers by document topic.

Additional documentation, including more detailed analyses of project-area resources, may be found in the project planning record located at the Potosi/Fredericktown Ranger District Office, Potosi, Missouri.

Purpose and Need for Action

This management area will emphasize management of shortleaf pine and associated plant communities on sites where ecological landtypes indicate that shortleaf pine is or was historically a dominant or characteristic member of the natural community. Fire management, cost, and use may be particularly intensive due to large pine management investments. Those wildlife species associated with shortleaf pine forest and early and mid-

successional stages of vegetation will be favored (FLRMP IV-125).

Ridges will have an open, park-like setting of oak and high pine trees standing at a distance wide enough from each other that few of the tree crowns touch. White, black, and post oaks are occasionally interspersed among the dominant shortleaf pine woodlands, especially in deeper hollows and northeast facing slopes. This park-like appearance will primarily be the result of prescribed burning intended to mimic historical fires that occasionally burned through these woodlands. These fires will occur with enough intensity and frequency that the understory is kept relatively open. A reduction in the accumulated fuel litter and an increased amount of sunlight reaching the forest floor will also be achieved using periodic controlled burns in some stands, and will result in allowing fire-adapted grasses, sedges, wildflowers, and ground shrubs to flourish in this light-rich environment. Where burning occurs, open, pine-dominated woodlands will transition and feather into more closed woodlands and forests on steeper slopes and valleys, especially along the major streams. Most of the tree canopy will remain continuous, but some larger gaps would be expected where fire behavior might have naturally excluded trees (especially on south and west-facing slopes).

Tree density would vary from approximately 30 to 70 square feet basal area for shortleaf pine, white oak, and other hardwood species per acre. Many stands will retain old growth pine and hardwood trees, along with dead snags, and a mix of other naturally regenerating mixed age classes. For older age classes, this MA will have at least 30% of the pine older than 100 years and most existing old growth pines, post oak, and white oak will remain unless contributing to insect or disease proliferation. In particular, pines characterized as flat-topped crowned trees with a diameter-at-breast-height (dbh) exceeding 18 inches will remain to provide an excellent reference point to old growth characteristics and for nesting trees. The forest canopy will indefinitely retain a portion of the overstory to retain visual quality and habitat for animal species that were characteristic of open pine woodlands, especially Bachman's sparrow and brown-headed nuthatch.

A variety of recreational opportunities will exist within the MA, and interaction between users will be low to high depending upon the specific location. Man-induced controls may be readily evident to the forest user. Due to intrusions of other activities, it is not guaranteed that all of the MA will offer solitude, independence, or closeness to nature for the user (FLRMP IV-125).

The forest within the MA will normally have substantial road access, although some roads may be closed periodically to meet management area objectives. The road network density will normally not exceed 2 miles per square mile of National Forest System land. All road classes, transmission line and pipeline corridors and other related facilities will be permitted. Facility design and density will be in harmony with a natural appearing environment. Mineral exploration and development may be permitted and coordinated with surface resources (FLRMP IV-125).

The MA will serve as a model for sustaining healthy populations of native plants and animals, especially the existing locations for rare and endangered species and will contribute to the sustainability of economic benefits to the local communities as well as sustainability of soil, water, and air resources.

Background (Need for Action)

Within the MA, the dramatic increase in oak and hickory regeneration (at the expense of original shortleaf pine/white oak/post oak dominance) has resulted in a closed canopy that has dramatically reduced the historic characteristic of open woodland flora, tree/shrub composition, woodland structure, and harmonious transition between natural communities. Dominance of shortleaf pine and white oak by basal area is much reduced from that recorded by land surveyors in the 1800s and today's forest is an altered artifact of natural resources exploited for at least 100 years following settlement. By 1920, much of Missouri's original quality timber was gone and a drastic decline in pine-dominated forests and woodlands resulted. It is estimated that shortleaf pine was reduced from 6.6 million acres prior to 1880 to less than 400,000 acres today (Cunningham and Hauser 1992). The result of this boom period, coupled with extended decades fire suppression and open-range grazing and subsequent severe soil erosion, has left the MA with an abundance of pioneering scarlet, black, and northern red oak that is gradually replacing white oak, post oak, and shortleaf pine. This greatly reduces and alters the pre-settlement forest's unique vegetation composition and soil productivity.

The onset of colonization by European immigrants has caused rapid, large-scale changes to the environment and the original healthy ecosystems to an unprecedented extent that continues today (Yatskievych 1999). Evidence is mounting that the pre-settlement character of existing terrestrial natural communities has been negatively affected over time. Early explorers in Missouri witnessed unbroken prairies of tall grass and brilliant wildflowers, described tall pineries of the Ozarks and their groundcover of rich herbs, and they saw wildlife that ranged across the open woodlands such as bison, elk, and deer. They also saw wildlife that has now virtually disappeared from Missouri, such as Bachman's sparrows, brown-headed nuthatches and red-cockaded woodpeckers, inhabiting open pine woodlands. Today, evidence of this past still exists, but mostly only in small, protected remnants called "natural areas". No longer do they exist on a landscape scale across the Missouri Ozarks.

The current conditions within the MA reflect these landscape changes that have negatively affected the terrestrial communities the Ozarks since European settlement. The existing forest structure is not resilient to a wide range of disturbances such as ice, wind, or snow storms, heavy precipitation, drought, insect and fungal diseases, or wildfires. For example, within the MA, there is a proliferation of oak decline as a result of oak borer infestations; disturbance-adapted species such as white oak, post oak, and shortleaf pine are scarce in the understory and continue to be overtaken

by less disturbance-adapted species such as black oak, scarlet oak, northern red oak and maple; a build-up of fuels continues to accumulate as the result of decades of fire suppression, making the forest and people's homes vulnerable to intensive wildfires; plant and animal diversity continues to decline as glades, fens, and open, grassland habitats gradually become dominated by shade-loving and fire-intolerant shrubs and trees. These and other conditions indicate that much of the MA is not in a healthy condition, but rather, at risk to ongoing, mostly uncontrollable, disturbances.

Purpose of the Actions

The purpose of this project is to restore parts of the MA to a healthy condition and ensure that the ecosystems that make up the MA are resilient to a wide range of disturbances. As a result of these actions, it is expected that the MA will be moved towards the Desired Future Condition previously described. It is also expected that these actions will lend themselves toward meeting the following objectives:

- Providing for the economically efficient production of shortleaf pine timber products;
- Providing for dispersed recreation opportunities featuring a roaded natural recreation environment;
- Providing for production of other resources such as hardwood timber products, recreation, forage, fish and wildlife, and minerals;
- Satisfy the management requirements of 36 CFR 219.27 and the Management Prescription for Management Area 4.1 in the FLRMP (FLRMP IV-125).

A broad variety of management practices would be featured, aimed at eventually restoring and maintaining the forest structure to a healthier condition. Resource outputs will be a by-product of managing various stages of restoration, depending on the initial characteristics of each stand.

As a means towards accomplishing this purpose, the following specific objectives and how these objectives may be met are being considered for this project:

1. ***Restore, maintain and enhance the shortleaf pine component within forest stands and on sites where ecological landtypes indicate that shortleaf pine is or historically was a dominant or characteristic member of the natural community.***

Thin and/or prescribed burn existing high density pine stands to improve the health of remaining pines and increase potential for natural pine regeneration in the understory; selectively remove hardwoods within mixed oak-pine stands to encourage pine growth; regenerate hardwood stands on pine ecological landtypes and prescribed burn to encourage mixed oak-pine regeneration.

2. ***Reduce the vulnerability of forest stands to threats such as insect infestations, disease, competition from invasive or non-native species, and catastrophic wildfire.***

Remove insect brood trees to reduce future insect outbreaks; thin high-density, homogenous stands, to reduce insect, fire, and disease spread; prescribed burn to reduce fuels build-up;

treat areas to eradicate invasive noxious or non-native species.

3. ***Protect the natural physical features (soils, water, geological features) from degradation.***

Close or repair system and non-system roads and user-developed trails that may be impacting soil and water resources; clean up dump sites, especially near streams; minimize soil disturbance and human activities near the Artesian well, glades, springs, fens, caves, and cliffs; protect the Castor River and other streamcourses by designating old growth forest corridors within drainages and protecting other riparian corridors; improve low-water crossings on Forest Roads 2199 and 2189.

4. ***Reduce threats to the public and adjoining landowners***.

Reduce hazardous fuel buildups near private lands by prescribed burning; reduce the number of hazardous trees near high public use areas such as roads, trails, and campsites.

5. Provide high-demand forest products to the general public.

Provide lumber to the local community by selling merchantable materials; allow firewood removal in areas after other activities are completed; provide upland water sources and grassy openings for game species; enhance habitat for bobwhite quail by prescribed burning and restoring open woodland habitats; provide cavity and den trees for game species such as raccoon, and eastern gray and fox squirrels by designating old growth stands and retaining hollow and cull trees in treatment areas.

Project Location

The Mark Twain National Forest (MTNF) is located in southern Missouri. It is scattered across the Missouri Ozarks encompassing an area of 285 miles east to west and 100 miles north to south. In addition, one unit is located in central Missouri. The Forest is divided into thirteen units located in nine contiguous blocks managed as six administrative units called Ranger Districts. Overall, Forest direction is provided through the Forest Supervisor's Office in Rolla, Missouri.

The Mark Twain is the only national forest in Missouri. There are approximately 1.5 million acres of National Forest System lands, which is approximately 58% of land within the proclamation boundaries of the forest. National Forest System lands are located in the following 29 counties: Barry, Bollinger, Boone, Butler, Callaway, Carter, Christian, Crawford, Dent, Douglas, Howell, Iron, Laclede, Madison, Oregon, Ozark, Phelps, Pulaski, Reynolds, Ripley, St. Genevieve, St. Francis, Shannon, Stone, Taney, Texas, Washington, Wayne, and Wright.

The East Fredericktown project area is located on National Forest System lands administered by the Potosi/Fredericktown Ranger District in Bollinger, Madison, St. Francois, and Ste. Genevieve Counties, east of Fredericktown, Missouri. The legal description of the project area is: Township 32 North, Range 7 East, Sections 11-13; Township 32 North, Range 8 East, Sections 3, 6-11, 15, 18, 19, 21-23, 25, 26, 34-36; Township 33 North, Range 8 East, Sections 29, 30, 35, 35; Township 34 North, Range 7 East, Sections, 12, 36; Township 34 North Range 8 East, Sections, 2-4, 9, 17, 19-

21, 28-33; Township 35 North, Range 8 East, Sections 9, 11-14, 16, 19-30, 34-36; Township 35 North, Range 7 East, Section 24, Fifth Principal Meridian.

Background

By the late 1800's and early 1900's, there were many areas in Missouri that had been badly abused and in need of protection and rehabilitation. The Ozarks Region was one area.

The Weeks Law, an Act of March 1911, enabled the Federal Government to look at suitable forest areas in Missouri for establishing National Forests. Prior to this legislation, all National Forests had been created from the public domain. Only in cooperation with the State of Missouri could the Federal Government begin buying land. Missouri had to pass enabling legislation implementing the provisions of the Weeks law. It took another piece of Legislation – The Clark-McNary Act of June 7, 1924 – before Missouri would pass an enabling act. The Clark-McNary Act enabled the Secretary of Agriculture to work cooperatively with State officials for better forest protection, chiefly in fire control and water resources. It also provided for continuous production of timber.

Missouri was added to Region 9 of the U.S. Forest Service in 1930. During 1934 and 1935, eight separate purchase units, embracing over 3 million acres was established. By the start of World War II, slightly more than 1.25 million acres had been approved for purchase by the National Forests Reservation Commission; and two National Forests, the Clark and the Mark Twain, had been established. The Mark Twain National Forest was combined with Clark National Forest as "The National Forests in Missouri" in 1973 and renamed "Mark Twain National Forest" headquartered in Rolla in 1976. Today, the Mark Twain National Forest is a direct result of the passage of time and active management and contains approximately 1.5 million acres under Public Ownership. Over the past 70 plus years, the Mark Twain National Forest has conducted numerous activities designed to encourage the growth and development of the forest and to create a mix of forest types and ages while providing for and maintaining unique habitats. Commercial timber harvests, prescribed fire, pre-commercial thinning, and tree planting have been the primary methods to achieve these objectives as well as various wildlife habitat projects. Available records indicate that a variety of commercial timber harvests were conducted from the 1980's and as recently as 1996. The most recent entry within the East Fredericktown Project Area had shelterwood cuts, preparatory treatments for uneven-aged management, oak savanna development, timber stand improvement, commercial thinning, overstory removal cuts, clear cuts, seedtree cuts, sanitation cuts as well as some wildlife opening maintenance. In addition the area had commercial pine thinning in 1999. Other activities including timber harvests in the vicinity of the East Fredericktown project over the last 10 years include: pond development and maintenance, oak savanna development, road reconstruction, preparatory treatments for uneven-aged management, overstory removal cuts, clearcuts, pine thinning and pre-commercial thinning. The analyses done for these projects did not reveal any significant effects from the proposed activities.

Forest-wide Direction and Goals

Forest-wide direction guides all natural resource management practices and established the management standards and guidelines for the Forest over the planning period. Management direction also includes the goals, (Land and Resource Management Plan, pages IV-1 to IV-4) objectives (Land and Resource Management Plan, pages IV-4 to IV-10), Forest-wide standards and guidelines (Land and Resource Management Plan, pages IV-11 to IV-86), management area prescriptions with their specific standards and guidelines (Land and Resource Management Plan, pages IV-87 to IV-234), and delineations of management areas.

The goals are concise statements describing a desired result to be achieved over the planning period, through implementing the Mark Twain National Forest - Land and Resource Management Plan. Multiple uses such as: recreation, wildlife, timber, transportation, fire, soil, water, and air management goals all apply to the East Fredericktown Project.

Desired Future Forest Condition of Management Area

The Mark Twain National Forest Land and Resource Management Plan (LRMP) allocated 17,334 Forest Service acres within the East Fredericktown Project Area to Management Areas 4.1, 8.1, and 9.1. These allocations identified desired future conditions and gave general management direction for each of the management areas found in the East Fredericktown Project Area.

Management Area 4.1

Management Area 4.1 is described by the following excerpts of Desired Future Condition (LRMP, page IV-125). "Generally these management areas will be 2,500 acres or more in size. The management of shortleaf pine on suitable sites is emphasized on management areas assigned this prescription. Other plant communities occur in substantial quantities. Forest age and size class distribution will vary across the landscape. These areas will normally have substantial road access. Some roads may be closed periodically to met management area objectives. Road network density will normally not exceed 2 miles per square mile of National Forest System land." "Those wildlife species associated with shortleaf pine forest and early and mid-successional stages of vegetation will be favored. Man induced controls may be readily evident to the forest user."

Ridges will have an open, park-like setting of oak and high pine trees standing at a distance wide enough from each other that few of the tree crowns touch. White, black, and post oaks are occasionally interspersed among the dominant shortleaf pine woodlands, especially in deeper hollows and northeast facing slopes. This park-like appearance will primarily be the result of prescribed burning intended to mimic historical fires that occasionally burned through these woodlands. These fires will occur with enough intensity and frequency that the understory is kept relatively open. A reduction in the accumulated fuel litter and an increased amount of sunlight reaching the forest floor will also be achieved using periodic controlled burns in some stands, and will result in allowing fire-adapted

grasses, sedges, wildflowers, and ground shrubs to flourish in this light-rich environment. These open, pine-dominated woodlands will transition and feather into more closed woodlands and forests on steeper slopes and valleys, especially along the major streams. Most of the tree canopy will remain continuous, but some larger gaps would be expected where fire behavior might have naturally excluded trees (especially on south and west-facing slopes).

Tree density would vary from approximately 30 to 70 square feet basal area for shortleaf pine, white oak, and other hardwood species per acre. Many stands will retain old growth pine and hardwood trees, along with dead snags, and a mix of other naturally regenerating mixed age classes. For older age classes, this MA will have at least 30% of the pine older than 100 years and most existing old growth pines, post oak, and white oak will remain unless contributing to insect or disease proliferation. In particular, pines characterized as flat-topped crowned trees with a diameter-at-breast-height (dbh) exceeding 18 inches will remain to provide an excellent reference point to old growth characteristics and for nesting trees. The forest canopy will indefinitely retain a portion of the overstory to retain visual quality and habitat for animal species that were characteristic of open pine woodlands, especially Bachman's sparrow and brown-headed nuthatch.

A variety of recreational opportunities will exist within the MA, and interaction between users will be low to high depending upon the specific location. Man-induced controls may be readily evident to the forest user. Due to intrusions of other activities, it is not guaranteed that all of the MA will offer solitude, independence, or closeness to nature for the user (FLRMP IV-125).

The forest within the MA will normally have substantial road access, although some roads may be closed periodically to meet management area objectives. The road network density will normally not exceed 2 miles per square mile of National Forest System land. All road classes, transmission line and pipeline corridors and other related facilities will be permitted. Facility design and density will be in harmony with a natural appearing environment. Mineral exploration and development may be permitted and coordinated with surface resources (FLRMP IV-125).
The MA will serve as a model for sustaining healthy populations of native plants and animals, especially the existing locations for rare and endangered species and will contribute to the sustainability of economic benefits to the local communities as well as sustainability of soil, water, and air resources.

Management Area 8.1
Management Area 8.1 is described by the following excerpts of Desired Future Forest Condition (LRMP, page IV-193). "These management areas contain exceptional ecological, geological, or other features of scientific, educational, scenic, or historical values other than Wilderness that have already been officially classified. This management prescription will ensure the continued protection of these unusual features or the landscape." "Plant and animal communities associated with these areas are often uncommon because they occur only in these limited portions of the total

landscape. Unless compatible with area objectives, management activities, facility development or motorized used will not be permitted. Interaction between users will vary from high to low, based on area objectives."

Within the project area, the areas that would fall within this MA include Wash Creek Alder Bog Fen (20 acres), Bidwell Creek Glade (5 acres), and Salamander Hollow (520 acres). These areas are currently Forest Special Areas and will be studied for State Natural Area Designation.
Activities such as management activities, facility development, and motorized use may occur within this MA if those activities contribute to or do not detract from the characteristics for which these communities were designated. Interaction between users will vary from high to low and these areas will normally be protected from mineral prospecting requiring surface disturbance (FLRMP IV-193).

Management Area 9.1
Management Area 9.1 is described by the following excerpts of Desired Future Condition (LRMP, page IV-217). "On management areas assigned this prescription, management practices will be limited to 1) those needed to protect life, health and safety of incidental users from man-made hazards, 2) the prevention of environmental damage caused by water, erosion, pests or fire and uninduced uses to National Forest System lands, adjoining ownerships and downstream areas, 30 the administration of unavoidable special uses and 4) compliance with those requirements of management that are not within the Forest Supervisors authority to deny". "These lands are low in output capability or have an unfavorable benefit-cost relationship."
In general, management activities will not occur within this MA unless required to a) protect forest users from man-made hazards, b) prevent environmental damage, c) fulfill administration of unavoidable special uses, or d) to comply with those requirements of management that are not within the Forest Supervisor's authority to deny. As a result, these lands are not intensively managed. They are considered unsuitable for timber production. Plant and animal diversity is determined primarily through the forces of nature. Public access may range from non-existent to excellent and there area opportunities for uninduced activities such as hunting, fishing, and other recreation (FLRMP IV-217).

Management Area Prescriptions

Management Prescription (MP) 4.14-17 (The East Fredericktown portion contains approximately 16,675 Forest Service acres)
Management Prescription (MP) 4.1 emphasizes the management of shortleaf pine in it's natural range on sites where it is recognized as a dominant or characteristic member of the natural community. The Mark Twain National Forest Land and Resource Management Plan defines the forest practices, standards, and guidelines for managing the MP 4.1 areas (LRMP, pp IV-125 to IV-132). The purpose of MP 4.1 includes:
To provide for the economically efficient production of shortleaf pine timber products.

To provide dispersed recreation opportunities featuring a roaded natural recreation environment.
To provide for production of other resources such as hardwood timber products, recreation, forage, fish and wildlife, and minerals.
To satisfy the management requirements of 36 CFR 219.27

Management Prescription (MP) 8.1 (The East Fredericktown portion contains approximately 646 Forest Service acres)
Management Prescription (MP) 8.1 describes a variety of designated "special areas" other than Wilderness. They exist for the protection of unusual environmental, recreational, cultural, or historical resources and for scientific or educational studies. New areas may be added to this prescription as they are evaluated. The Mark Twain National Forest Land and Resource Management Plan defines the forest practices, standards, and guidelines for managing the MP 8.1 areas (LRMP, pp IV-193 to IV-216). The purpose of MP 8.1 includes:

- To provide areas of special scientific, biological, historical, geological, scenic, recreational, and educational significance.
- To provide low to moderate production of other resources such as timber products, fish and wildlife, recreation, and forage where they are compatible with "special area" objective.
- To satisfy the management requirements of 36 CFR 219.27

Management Prescription (MP) 9.1 (The East Fredericktown portion contains approximately 13 Forest Service acres)
Management Prescription 9.1 applies to lands not needed to meet projected demands for the next 50 years, or lands that are currently uneconomical for resource investment. The Mark Twain National Forest Land and Resource Management Plan defines the forest practices, standards, and guidelines for managing the MP 9.1 areas (LRMP, pp IV-217 to IV-222). The purpose of MP 9.1 includes:

- To provide direction for these lands.
- To minimize the cost of keeping the land in public ownership.
- To identify the fixed cost of retaining National Forest System lands and the level of uninduced outputs that occurs from them.
- To satisfy the management requirements of 36 CFR 219.27.

Proposed Action

The proposed land management activities proposed by the Forest Service to meet the purpose and need, and to contribute to a sustainable forest ecosystem include the following, with approximate values:
-Seed tree harvests (850 acres) to create early successional habitat through regeneration of pine/oak stands.
-Shelterwood harvest (1482 acres) to provide suitable conditions for semi-open habitat and pine/oak regeneration.
-Uneven-aged management (UAM) (362 acres) to maintain continuous high forest cover, periodic regeneration of desirable species, and orderly growth and development of trees through a range of diameter and age classes.
-Overstory removal (65 acres) to maintain the health of the stand and not inhibit the new stands growth potential.
-Thinning and sanitation cuts (1971 acres) to remove high risk and low

quality trees and enhance residual tree survival, health, and growth.
-Natural reforestation (2605 acres) providing for the reestablishment of tree cover by natural seed fall, sprouting, or suckering of vegetation.
-Timber stand improvement to include release (173 acres) to promote growth and survival of shortleaf pine, and to improve composition and stand vigor.
-Crop tree release (1606 acres) to ensure a desired composition and provide healthy conditions in young forested stands.
-Prescribed burning (2603 acres) to increase understory diversity, improve natural pine and oak regeneration, and reduce hazardous fuels.
-Riparian and special area protection (646 acres) to protect biological communities or geological sites that preserve and perpetuate the natural character, diversity, and ecological processes of Missouri's native landscapes
-Designation of old growth habitat (1693 acres) to provide future habitat for wildlife species dependent on forest stands containing large diameter trees, snags, and fallen logs.
-Dumpsites have been identified and will be cleaned up within the project area.

-Reconstruction or maintenance of 33.5 miles of roads to accomplish items listed above.

Decision Framework

Given the purpose and need, the deciding official reviews the proposed action, the other alternatives, and the environmental consequences in order to make the following decisions:

- Whether the proposed activities and alternatives are responsive to the issues, accomplish Forest Plan direction, and meet the purpose and need as defined for the East Fredericktown Project,
- Which actions or alternative to approve and implement,
- Whether the information in this analysis is sufficient to implement the proposed activities, and
- If the activities can be implemented in a timely manner.

Public Involvement

The Notice of Intent (NOI) was published in the Federal Register on April 29, 2003. A 30-day scoping period was used after the Notice of Intent was published in the FEDERAL REGISTER, as is the customary length of comment period for proposed actions published in the Register. The agency distributed a news release which was published in the Rolla Daily news on May 4, 2003 and the Potosi Independent-Journal on May 8, 22, and 29, 2003. On April 29, 2003 a letter with map and project description were sent to the district mailing list (144 addressees) to invite comments on the project. This project has also appeared in the forest wide Schedule of Proposed Actions (SOPA) since July 2003.
In addition, on April 29, 2003 a Forest Plan revision meeting was held in Fredericktown, MO and the scoping letter, map, and a project description were available for review and comment. The scoping letter, map, and a project description were also posted on the Public Involvement page of the Mark Twain National Forest website. Comments received after the scoping period were evaluated in the development of issues and alternatives to the proposed action.

Contributing Agencies

Federal

USDI Fish and Wildlife Service

The Forest Service works in close cooperation with the United States Department of Interior Fish and Wildlife Service. In 1984, the Forest Service requested formal consultation with the FWS on the Forest plan. On August 8, 1985 FWS issued a non-jeopardy biological opinion for seven species: bald eagle, Indiana bat, gray bat, Ozark big-eared bat, Curtis' pearly mussel, pink mucket pearly mussel and the Higgins' eye pearly mussel.
In May 1998, the Mark Twain National Forest entered into formal consultation with FWS with regard to the potential effects of implementation on activities as outlined in the Forest Plan on four federally threatened and endangered species (Indiana Bat, Gray Bat, Bald Eagle and Mead's Milkweed). Formal Consultation was concluded on June 23, 1999 when the FWS issued their Biological Opinion (BO). All management activities proposed within the Analysis Area are subject to the reasonable and prudent measures and associated terms and conditions of this BO.

USDA Department of Agriculture Forest Service North Central Research Station

The Research branch of the National Forest System develops the scientific information needed to protect, manage and use the renewable natural resources of the Nation's forests and rangelands. North Central has been the leading Federal agency for natural resource research and development in the Midwest. Providing the scientific basis for decisions and policies that affect the management and use of forests in the region.

North Central's research provides the Mark Twain National Forest with credible, relevant knowledge and new technologies that can be used to sustain the health, productivity, and diversity of the forest to meet the needs of present and future generations. Private landowners also benefit from this organization's research findings to better sustain the health, productivity, and diversity of their lands.

Cooperation between Sinkin Experimental Forest and the Mark Twain National Forest is outlined in the Forest Plan under the 8.1 Management Prescription.

State

Missouri Department of Conservation

Employees from the Missouri Department of Conservation worked in cooperation in the development of the Forest Plan as well as in providing habitat and population data for the state wildlife resources. (A Memoranda of Understanding with the intent of strengthening, at all levels of the two agencies their cooperative approach to the management of fish, wildlife, plants, and their habitats on NFS lands was signed in March of 1997).

Missouri Department of Natural Resources-State Historic Preservation Office (SHPO)

A Memorandum of Understanding between the Forest and SHPO outlining the stipulations to be meet by the Forest Service to satisfy Section 106 responsibility for all individual undertakings was put into place in June of 1995. This agreement defines the review of the Forest Heritage Program through effective and efficient specific procedures to exclude routine activities that do not have the potential to affect historic properties.

Issues

The Forest Service separated the issues into two groups: significant and non-significant issues. Significant issues were defined as those directly or indirectly caused by implementing the proposed action. Non-significant issues were identified as those: 1) outside the scope of the proposed action; 2) already decided by law, regulation, Forest Plan, or other higher level decision; 3) irrelevant to the decision to be made; or 4) conjectural and not supported by scientific or factual evidence. The Council on Environmental Quality (CEQ) NEPA regulations explain this delineation in Sec. 1501.7, "…identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review (Sec. 1506.3)…" As for significant issues, the Forest Service identified the following issues during scoping:

Issue A: Regeneration of Shortleaf Pine: The shortleaf pine community on the Mark Twain National Forest is unique to the southeastern United States and exists nowhere else in the world. Although shortleaf pine occurs as a co-dominant in other areas of the country, it is the only native pine species in the Missouri Ozarks and the dominant member of the pine community. Historically, shortleaf pine covered almost 6.6 million acres in the Missouri Ozark Highlands but only 10% of that remains today.
As pine was removed from many of the stands during harvest in the 1920s, scarlet and black oaks replaced the more resilient shortleaf pine. After shortleaf pine management practices are implemented, reforestation will be accomplished by natural pine regeneration

Measure: Estimated acres of regeneration.

Issue B: Insect and Disease Infestation affecting Forest Health: Forested lands that are in both public and private ownership are at risk from insect and disease attacks. The composition of tree species currently on those lands is part of the problem. The question is, what can be done (type of harvest) or should be done to improve the quality and health of the stands in the project area? The mix of harvest treatments and how these treatments would be implemented will be critical to controlling the spread of insect and disease in both high risk and healthy tree species.

Measure: Planned acres of treatment in high risk or low quality stands.

Issue C: Hazardous Fuels Reduction: Another concern expressed by both the public and agency employees is the potential risk for severe or catastrophic wildfire in the Analysis Area. Items of concern are safety of firefighters and public in path of wildland fires; damage to private property, forest resources, fences, and power-lines resulting from the increased availability of fuels in the Forest due to numbers of dead standing and fallen trees; and the effects of the extended drought on fuel moisture levels. In the last few years, the District has experienced more severe fire behavior due to these factors. Without removal of these fuels, the trend for damage to private and public property and resources will continue. One other concern is the smoke from wildland fires as a safety concerns for road users and workers in the mines found throughout the area.

Measure: Acres treated

Issue D: Commercial Logging: Some commenters on similar projects have suggested treating the insect and disease problem without commercial logging. Some commenters on similar projects wanted to see more commercial harvest and on a larger scale.

Measure: Acres to be harvested.
Measure: Acres to be treated without commercial harvest.

Issue E: Roads:

Roads are a source of concern in the East Fredericktown Project area. They provide access to areas that were previously undisturbed, thus disrupting the natural seclusion of an area that some wish to enjoy without the intrusion of vehicles. Others feel that it is a responsibility of the Forest Service to provide access to all segments of its land.

Currently within the East Fredericktown Project area there are many miles of non-system roads, or user made roads that are used by off road vehicles and four wheelers. These roads are not maintained by the Forest Service and in some areas can destroy Cultural Resource sites, create erosion problems, and are hazardous to the users.

Measure: Miles of new roads created; miles of non-system road closures.

Issue F: Ecosystem Restoration / Biodiversity:
There is a responsibility of the Forest Service and an ongoing effort to preserve and enhance the local ecosystems of the area and maintain and improve the biodiversity when possible. The methods used to accomplish any type of ecosystem restoration are of some debate.

Some people feel that it is best to let nature take its course; and that will result in a healthy, functioning ecosystem. They are concerned that human use of the site's resources (i.e. timber products and constructed roads) is incompatible with healthy ecosystem functioning.

Others feel that active intervention is necessary to heal past abuses and encourage the composition, structure and functions that comprise a healthy woodland ecosystem. These people believe that humans are an integral part of a healthy ecosystem.

Measure: Acres improved by management activities considered likely to increase biodiversity include timber treatments, prescribed burning, pond/vernal pool maintenance and establishment, old growth designation and glade restoration. All of these activities create habitat conditions currently limited within the analysis area.

Relationship to Other Documents

The Mark Twain National Forest Land and Resource Management Plan

Mark Twain National Forest Land and Resource Management Plan Final Environment Impact Statement and Record of Decision (Mark Twain National Forest 6/86, as amended).

The Forest plan is a programmatic document, which is required by the rules implementing the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA), as amended by the National Forest Management Act of 1976 (NFMA). The purpose of the Forest Plan is to provide direction for the multiple uses and the sustained yield of goods and services from National Forest System lands (NFS) in an environmentally sound manner.

The Forest Plan sets management direction for the Mark Twain National Forest through the establishment of short-term (10-15 years) and long-range goals and objectives through the year 2035. It prescribes the standards, practices, approximate timing and locations needed to achieve goals and objectives. The Plan prescribes the monitoring and evaluation needs necessary to ensure that direction is carried out, measures quality and quantity of actual operations against predicted outputs and effects, and forest the basis for implementing revisions.

The Secretary of Agriculture shall not be considered to be in violation of subparagraph 6(f)(5)(A) of the forest and Rangeland Renewable Resources Planning (RPA) of 1974 (16 USC 1604(f)(5)(A)) solely because more than 15 years have passed without revision of the plan for a unit of the NFS (FY2002 Interior appropriations Bill, Section 327).

Following the signing of these earlier documents the Forest Plan has been amended to reflect new information concerning threatened, endangered, and sensitive species. This project Analysis reflects those amendments and supplemental information reports to the Forest Plan.

Forest-wide direction guides all natural resource management practices and established the management standards and guidelines for the Forest over the planning period. Management direction also includes the goals, (Land and Resource Management Plan, pages IV-1 to IV-4) objectives (Land and Resource Management Plan, pages IV-4 to IV-10), Forest-wide standards and guidelines (Land and Resource Management Plan, pages IV-11 to IV-86), management area prescriptions with their specific standards and guidelines (Land and Resource Management Plan, pages IV-87 to IV-234), and delineations of management areas.
The goals are concise statements describing a desired result to be achieved

over the planning period, through implementing the Mark Twain National Forest - Land and Resource Management Plan. Multiple uses such as: recreation, wildlife, timber, transportation, fire, soil, water, and air management goals all apply to the East Fredericktown Project.

Management prescription 4.1 (IV-125 to IV-131) Management Prescription (MP) 4.1 emphasizes the management of shortleaf pine in it's natural range on sites where it is recognized as a dominant or characteristic member of the natural community.

Management Prescription 8.1 (IV-93 to IV-200) Management Prescription (MP) 8.1 describes a variety of designated "special areas" other than Wilderness. They exist for the protection of unusual environmental, recreational, cultural, or historical resources and for scientific or educational studies**.**

Management Prescription 9.1 (IV-217 to IV-222)
Management Prescription 9.1 applies to lands not needed to meet projected demands for the next 50 years, or lands that are currently uneconomical for resource investment.

Mark Twain National Forest Programmatic Biological Assessment (Mark Twain National Forest September 1998) and Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray bat, Bald eagle, Indiana bat, and Mead's milkweed on the Mark Twain National Forest, Missouri (U.S. Fish and Wildlife Service, June 1999)

Federal agencies are required to comply with provisions of the Endangered Species Act (ESA) of 1973, as amended. This includes a requirement to consult with the U.S. Fish and Wildlife Service on projects, which may affect species federally listed as threatened or endangered (TE). These documents update the original consultation completed for the Forest Plan in 1985. They include species not originally consulted on and describe potential effects to federally listed species of activities that implement the Forest Plan. The Biological Opinion 1) determined that implementation of the Forest Plan would not jeopardize the existence of any of the species considered, 2) exempted the Forest Service from a specified amount of incidental take on three species, and 3) described mandatory Reasonable and Prudent Measures (RPM) along with associated Terms and Conditions (TC) to minimize the impacts of incidental take on the MTNF. The Forest Plan was subsequently amended March 2000 to include the RPM/TC as standards and guidelines. A decision on the proposed amendment for management of Areas of Influence was signed on November 16, 2001.

This analysis is tiered to the following documents:

- The Mark Twain National Forest Land and Resource Management Plan Final Environmental Impact Statement and Record of Decision (6/86), as Amended, including all supplemental information reports.

- Mark Twain National Forest Programmatic Biological

Assessment (Mark Twain National Forest September 1998).

- Biological Opinion on the Impacts of Forest Management and Other Activities to the Gray bat, Bald eagle, Indiana bat, and Mead's milkweed on the Mark Twain National Forest, Missouri (U.S. Fish and Wildlife Service, June 1999).

The following analysis are incorporated by reference:

The Mark Twain National Forest Monitoring and Evaluation Reports from FY 1987 through FY 2002.

Site-Specific Environmental Analyses: (Within a portion of the project area)

Project Tornado (8/5/2002), 759 acres

(Adjacent to the project area)

12 Mile Project (9/8/1995), 18,600 acres

Other Documents

Ozark-Ouachita Highlands Assessment (December 1999)

CHAPTER 2. ALTERNATIVES, INCLUDING THE PROPOSED ACTION

Introduction

This chapter describes and compares the alternatives considered for the East Fredericktown Project. It includes a description and map of each alternative considered. This section also presents the alternatives in comparative form, sharply defining the differences between each alternative and providing a clear basis for choice among options by the decision maker and the public. Some of the information used to compare the alternatives is based upon the design of the alternative (i.e., helicopter logging versus the use of skid trails) and some of the information is based upon the environmental, social and economic effects of implementing each alternative (i.e., the amount of erosion caused by helicopter logging versus skidding).

Alternatives Considered in Detail

The Forest Service developed three alternatives, including the No Action and Modified Proposed Action alternatives, in response to issues raised by the public and internal scoping.

Alternative 1

This alternative responds to the issue of improving forest health and vigor in the project area without the use of commercial harvests. Old growth is designated as under Alternative 2.

This alternative allows stands to be treated mechanically to achieve stand conditions that would favor regeneration and renewal, but without commercial harvest. Following mechanical treatment, several selected stands would be treated with prescribed fire to reduce hazardous fuels created through treatment. Firewood gatherers may be allowed in selected areas after mechanical operations are completed.

This alternative uses prescribed burning for various primary objectives, including site preparation for seedling development, restoration of open woodlands with native groundcovers such as sedges and forbs, and for reduction of hazardous fuels. The number of prescribed areas for burning to reduce hazardous fuels increases substantially over Alternative 2.

Reforestation treatments change substantially and are largely correlated with prescribed burning for site preparation. Timber stand improvement activities are slightly less than in Alternative 2.

Since there is no commercial activity, roads would not be reconstructed to access and facilitate harvest. Roads would continue to receive maintenance as needed.

This alternative would move the existing condition of the Forest towards the Desired Future Condition of habitats as outlined in the Forest Plan, though at a slower rate.

Acres to be restored by Mechanical Methods (acres approximate):
Cutting the same trees designated in previous alternatives would treat these stands.
850 acres of heavy mechanical
(Heavy amounts of species experiencing decline, remaining area would resemble seed tree and final harvests.)
3819 acres of moderate mechanical
(Moderate amounts of species experiencing decline, remaining area would resemble shelterwood and thinning harvests.)

Prescribed Fire Activities (acres approximate):
76 acres for restoring open woodlands
2603 acres for hazardous fuel reduction and reforestation site preparation.

Old Growth Designation (acres approximate):
1693 acres for designation.

Glade Restoration and Vernal Pool Establishment/Pond Maintenance (acres approximate):
3.4 acres of vernal pool establishment/pond maintenance.

Riparian and Special Area Protection:
Relocation of the portion of the Audubon Trail currently located in the floodplain of Bidwell Creek and construct two trailheads.

Rehabilitation of Artesian well and surrounding area and create interpretive signing to enhance the continued public use of the site.

Reduction of sediment deposition into the Castor River at Marquand: Frequent road maintenance and seasonal closure, if required, will be considered.

Alternative 2

Proposed Action

This alternative was developed to emphasize the management of shortleaf pine in its natural range on sites where it is recognized as a dominant or characteristic member of the natural community, and examine opportunities to minimize adverse impacts from insects and disease on forest vegetation. Species composition will be improved to provide a more resilient and sustainable

mix; recover valuable sawtimber before it deteriorates further; reduce the impacts of hazardous falling trees and fuel levels to improve safety for forest users; and work towards the objectives for old growth in all management prescriptions affected by this proposal. This alternative also responds to the need to continue wildlife habitat maintenance and improvement, recreation management, examination of road system needs, cleanup of illegal dumps, and associated or connected actions. This alternative includes burning, thinning and burning, and burning only to reduce the risk of catastrophic fire across the project area by reducing the load, and disrupting the continuity of fuel in stands identified as dense pine woodlands. In this alternative, "catastrophic" is defined as substantial damage from wildfire to existing vegetation and developments. Wildfire is considered an unplanned fire that burns organic soil, grasses and forbs, shrubs, trees, and associated fuels in the natural or modified state.
This modified alternative implements a portion of the National Fire Plan (NFP) developed to identify and list priority areas that would benefit from hazardous fuel reduction treatments. This list includes 84 communities within Missouri.

Congress directed the USDOI and USDA to work with governors to develop a national 10-year Comprehensive Strategy to deal with wildland fire and hazardous fuels situation. This strategy identified prioritizing hazardous fuels reduction where the negative impacts of wildland fire are the greatest as one of its major goals. The strategy acknowledges the importance of fire suppression, but indicates the need for a shift in fire management emphasis from a reactive approach to a proactive approach. The focus is on hazardous fuels reduction, integrated vegetation management, and fire-fighting strategies (USDOI & USDA 2001).

This alternative uses a mix of commercial harvest, non-commercial thinning, reforestation treatments, and prescribed burning to emphasize shortleaf pine and minimize the adverse effects of insects and disease. A substantial number of acres are treated with commercial harvest. These harvests are designed emphasize shortleaf pine management and reduce the adverse effects of insects and disease, while creating stand conditions for the residual stand that best promote future sustainable forest communities. Firewood gatherers may be allowed in selected areas after harvesting operations are completed.

This alternative uses prescribed burning for various primary objectives, including site preparation for seedling development, restoration of open woodlands with native groundcovers such as sedges and forbs, and for reduction of hazardous fuels. These prescribed burning treatments would also improve wildlife habitat, for the short term, and in some cases, i.e. open woodlands, for the long term.

Reforestation activities are proposed to allow suitable light conditions to promote the development of desired tree seedlings, herbaceous vegetation, and shrubs. The amounts of treatment depend on the amount of even-aged and uneven-aged regeneration proposed. Timber stand improvement activities are

proposed to guide stand development and to regulate species composition to those best suited for the site. Release potentially increases species richness on a site and is expected to improve tree species composition and stand vigor in the long term.

In addition, this alternative will reduce the risk of catastrophic fire across the project area by reducing the load and disrupting the continuity of fuel in stands identified as dense pine woodlands. In this situation, "catastrophic" is defined as substantial damage from wildfire to existing vegetation and developments. Wildfire is considered an unplanned fire that burns organic soil, grasses and forbs, shrubs, trees, and associated fuels in the natural or modified state. This alternative responds to this need by using combinations of pine thinning and prescribed burning to: interrupt the fuel continuity, increase crown spacing, or both; reduce the available long-term fuel loads; and maintain stand health to delay tree mortality induced by crowding. Road reconstruction, temporary roads and fire lines would be needed to access and facilitate treatments.

Dumpsite cleanup and Riparian and Special Area Protection are included in this alternative. Clean-up will be accomplished by hand tools or rubber tired loaders and dump trucks.

This alternative would move the existing condition of the Forest towards the Desired Condition for wildlife habitat as outlined in the Forest Plan.

Silvicultural Methods (acres approximate):
850 acres of seed tree
1482 acres of shelterwood
362 acres of uneven-aged management
1971 acres of sanitation and thinning
65 acres of over-story removal

Reforestation and Timber Stand Improvement (Release) Activities(acres approximate):
2605 acres of natural regeneration
1606 acres of crop tree release
173 acres of pine release (short leaf pine release)

Prescribed Fire Activities(acres approximate):
76 acres for restoring open woodlands
2603 acres of prescribed fire for wildlife habitat improvement, wildlife habitat restoration, and hazardous fuels reduction

Transportation Activities(miles approximate:
33.5 miles of road reconstruction or maintenance

Old Growth Designation(acres approximate):
1693 acres for designation

Glade Restoration and Vernal Pool Establishment/Pond Maintenance (acres approximate):
32 acres of glade restoration and 3.4 acres of vernal pool establishment/pond maintenance.

Riparian and Special Area Protection:

Relocation of the portion of the Audubon Trail currently located in the floodplain of Bidwell Creek and construct two trailheads.

Rehabilitation of Artesian well and surrounding area and create interpretive

signing to enhance the continued public use of the site.

Reduction of sediment deposition into the Castor River at Marquand: Frequent road maintenance and seasonal closure, if required, will be considered.

Alternative 3

No Action

This alternative provides a baseline (reference point) against which to describe the environmental effects of the action alternatives. This is a viable alternative and responds to the concerns of those who want no activities to take place. The option for future management in this area would not be foreclosed.

If Alternative 1 is selected, current and on-going management activities would continue, but no new management activities would be initiated. In addition, no new old growth would be designated, given that no project activities would be implemented. Since there is no commercial activity, roads would not be reconstructed to access and facilitate harvest. Roads would continue to receive maintenance as needed.

Fire suppression would continue in the East Fredericktown Project Area.

Wildlife – Comparison of Alternatives

Forest Plan Habitat Objectives for Wildlife

The Forest Plan identifies eight habitat objectives that are to be used to indicate viable populations of terrestrial wildlife species on the Mark Twain National Forest. There are two levels of habitat objectives established in the Forest Plan for achieving and maintaining terrestrial wildlife species' viability. One level represents the Minimum Viable Population (MVP); the other level represents the Desired Future Condition (DFC) level. Projects should be planned with an objective of moving the analysis area toward the DFC level, and not below the MVP levels for each habitat objective.

The majority (96%) of the analysis area is within the 4.1 Management Prescription (MP), and two Landtype Associations (LTAs) (Oak-Pine Hills & Plains). Within the analysis area, the 4.1 MP area includes approximately 16,666 acres of National Forest. Table 2-1 identifies the eight wildlife habitat objectives for the 4.1 MP and the two LTAs that are included in the analysis area. This table also compares the three alternatives being considered and describes how each alternative best meets the MVP and DFC levels for the 4.1 MP and Oak-Pine Hills & Plains LTAs.

Table 2-1. Wildlife habitat objective levels for each alternative and Forest Plan MVP and DFC levels for the Oak-Pine Hills and Plains LTAs when they occur within the 4.1 MP.

Habitat Objective	Forest-wide MVP & DFC levels	Existing Analysis Area Levels	Alt. 1	Alt. 2	Alt. 3	Alternative that best meets DFC levels
1. Woodland habitat in the 0-9 year age class	4% 8-15%	2.7%	5.1%	5.1%	2.7%	Alt. 1 & 2, at equal levels
2. Woodland habitat in the old growth condition:	5% 8-10%	4.4%	3.4% short term 10.2% long term	3.4% short term 10.2% long term	3.4% short term Possibly none long term	Alt. 3 in short term; Alt. 1 & 2, at equal levels in long term; Alt 3 does not designate old growth so none may be retained long term
3. Woodland habitat in the oak and oak-pine types over 50 years of age	25% 30-40%	62%	57%	57%	62%	Alt. 1 & 2, at equal levels, in short & long term
4. Woodland habitats in pole and sawtimber size classes with crown closure over 80 %	20% 35-45%	74%	48.0%	46.6%	74%	Alternative 2
5. Woodland sawtimber habitat in the oak, oak-pine, and pine type that has a condition of 20-30% forbs, grass, and shrub ground cover	20-30% 25-35%	8.5%	44.1%	44.2%	8.5%	Alternative 1
6. Woodland habitat in the oak type over 50 years of age with dense understory	10% 10-15%	9.5%	20.0%	20.8%	9.5%	Alternative 3 short term; Alternative 1 long term
7. Open and semi-open habitat	1% 4-10%	1.7%	1.7% short term 0.5% long term	1.7% short term 0.5% long term	1.7% short term 0% long term	Alt 3 in short term; Alt 1 & 2, at equal levels, in long term
8. Permanent water sources per square mile	1 1-2	0.8	1.3	1.3	0.8	Alternatives 1 & 2,at equal levels

Short term = immediately following implementation; Long term = at least ten years beyond implementation

For wildlife habitat objectives that emphasize older age classes, such as old growth, and oak or oak-pine stands over 50 years of age, Alternative 3 provides

the most habitat that would meet these objectives in the short term, simply because it does not reduce the amount of mature forest within the analysis area. However, for many of these wildlife habitat objectives, a reduction is desirable, in order to more closely meet Forest Plan DFC levels. Alternative 3 would not meet the MVP levels in the short or long term for four of the eight wildlife habitat objectives. When the Forest Plan MVP and DFC levels are taken into consideration, Alternatives 1 and 2 move the analysis area more closely to the DFC levels for the eight wildlife habitat objectives than Alternative 3. Alternative 1 would move the analysis area slightly closer to the DFC levels for two habitat objectives than Alternative 2, but at less than 1% more, so the difference between these two alternatives is not likely significant.

Road Effects upon Wildlife

The presence of roads can affect wildlife in many ways. These effects can include habitat loss and fragmentation, edge effects, and increased mortality and disturbance of wildlife. In this analysis, various indices were determined for each alternative to help quantify potential effects roads may have upon wildlife. Of the three alternatives considered, Alternative 2 furthest reduce the potential for negative effects of roads upon wildlife. A comparison of alternatives and the effects roads associated with each alternative may have upon wildlife is shown in Table 2-2. These density figures were calculated using all types of roads on all types of land.

Table 2-2. Effects of roads upon wildlife for each alternative proposed.

Unit of Measure	Alt. 1	Alt. 2	Alt. 3	Potential Effects upon Wildlife
Road Density (miles/sq. mile)	2.7	2.3	2.7	As road density increases, negative impacts upon wildlife such as habitat disturbance, road kill, and changes in their population distributions would likely also increase.
Acres within "Road Effect Zones"	17,135	16,320	17,135	These zones represent areas in which wildlife species would be most vulnerable to human activities and habitat conditions created by the roads.
No. of "road-free" areas > 500 acres on National Forest within analysis area	5	7	5	These areas would offer the best blocks of habitat on National Forest in the project area for species that tend to avoid roads and human use areas.
No. of "road free" acres > 500 acres on National Forest within analysis area that would not be affected by timber regeneration activities	4	4	5	These areas represent the best blocks of habitat on National Forest in the project area for species that require large tracts of mature, forest interior habitat.

Management Indicator Species

Also identified in the Forest Plan are several species considered to be indicators of the general forest condition and its ability to provide for overall wildlife species' viability. These species are considered Management Indicator Species (MIS). These MIS are connected to many of the habitat objectives that have been identified in the Forest Plan.

Each of the proposed alternatives would affect habitat for these MIS species in various, and often different, ways. The expected direct and/or indirect effects of each alternative upon these MIS for each alternative are identified in Table 2-3. None of the alternatives is expected to contribute to a negative cumulative effect upon any MIS.

Table 2-3. Summary of anticipated effects of proposed alternatives upon Management Indicator Species for the Oak-Pine Hills & Plains LTAs.

Species	Alt. 1	Alt. 2	Alt. 3	Alternative best for this species Short term	Alternative best for this species Long term
Pileated woodpecker	Reduce habitat	Reduce habitat	Maintain habitat short & long term	Alternative 3	Alternative 3
Ovenbird	Reduce habitat short term; improve habitat long term	Reduce habitat short term; improve habitat long term	Maintain habitat short term; reduce habitat long term	Alternative 3	Alternative 1
Wild turkey	Improve habitat	Improve habitat	Maintain habitat short term; reduce habitat long term	Alternative 2	Alternative 2
White-tailed deer	Improve habitat	Improve habitat	Maintain habitat short term; reduce habitat long term	Alternative 2	Alternative 2
Raccoon	Improve habitat	Improve habitat	Maintain habitat	Alternative 2	Alternative 2
Wood thrush	Reduce habitat short term; improve habitat long term	Reduce habitat in short term; improve habitat in long term	Maintain habitat short term; reduce habitat long term	Alternative 3	Alternative 1
Ruffed grouse	Improve habitat	Improve habitat	Maintain habitat short term; reduce habitat long term	Alternative 2	Alternative 2
Bobcat	Improve habitat	Improve habitat	Maintain habitat short term; reduce habitat long term	Alternative 2	Alternative 2
Indigo bunting	Improve habitat	Improve habitat	Maintain habitat short term; reduce habitat long term	Alternative 2	Alternative 2

Short term = immediately after implementation; Long term= at least 10 years beyond implementation

Overall, Alternative 3 would provide the most short term habitat for pileated woodpecker, ovenbird, wood thrush, and other species that are dependent primarily upon mature forests.

In the long term, however, ovenbirds, wood thrushes, and many other species may not be provided for by Alternative 3 because eventually, as stands continue to mature, there would be an expected loss of shrub and forb understory within these stands. Over time, the loss of shrubs and forbs in mature stands would reduce the suitability of these stands for ovenbirds and wood thrushes. The remaining MIS prefer either early successional forest or a mix of early successional forest and mature forest. Alternatives 1 and 2 propose activities that would increase or maintain a shrub/forb understory and create both short and long term habitat for species that prefer early successional forest, open habitats, and mature forest. Because Alternative 2 provides slightly more early successional habitat than Alternative 1, it would best meet the needs of species more closely tied to scrub-shrub habitat (indigo bunting, ruffed grouse, bobcat, wild turkey, and white-tailed deer). When compared to Alternative 2, Alternatives 1 and 3 would provide more mature forest habitat, but Alternative 1 would also increase the shrub component of stands and, therefore, would be more beneficial to ovenbirds and wood thrushes than Alternatives 2 or 3.

Federally Threatened and Endangered Species

Effects of the three proposed alternatives upon twelve federally-listed species were evaluated in a Biological Assessment/Evaluation (BAE) prepared for this analysis (Appendix A). The BAE determined that Alternatives 1 and 2 would have "no effects" upon five species and "are not likely to adversely affect" seven other species. The BAE determined that Alternatives 1 and 2 "may adversely affect" the Indiana bat. However, none of the effects disclosed in the BAE for the Indiana bat would be beyond those previously evaluated at a programmatic level on the Mark Twain National Forest with the US Fish and Wildlife Service (US Forest Service 1998; US Fish and Wildlife Service 1999). The BAE determined that Alternative 3 would either have "no effect" or would "not likely adversely affect" any of the twelve listed species, including Indiana bat.

Regional Forester's Sensitive Species and other Species of Concern

Effects of the three proposed alternatives upon Regional Forester's Sensitive Species and other Species of Concern were evaluated in a BAE prepared for this analysis (Appendix A). The BAE determined that Alternatives 1 and 2 would have "no impact' upon any RFSS or Species of Concern restricted primarily to streams/rivers, grasslands, caves, or wetlands. The BAE determined that Alternatives 1 and 2 "may impact individuals or habitat but will not likely contribute to a trend towards federal listing or loss of population viability" for RFSS or Species of Concern that are primarily restricted to riparian areas, forested habitats and slopes, glades, seeps/fens, and bluffs. The BAE determined that Alternative 3 would have "no impact" upon any RFSS or Species of Concern.

Specialized Habitats

The anticipated effects of each of the three proposed alternatives upon a variety of specialized habitats are disclosed in Table 2-7 at the end of this chapter.

Birds (emphasizing Neotropical Migrants)

Alternatives 1 and 2 provide more habitat for birds that prefer early successional forest, scrub-shrub habitat, forest edge, and open forest canopies than Alternative 3, in both the short and long term. Alternative 3 would provide the maximum amount of habitat for birds that prefer relatively undisturbed, large tracts of mature forest, with a dense closed-canopy, and little understory. Cowbird parasitism and nest predation levels are

expected to be low for all alternatives, but would likely be lowest under Alternative 3, because this alternative would create the least amount of edge habitat. At nearly equal levels, Alternatives 1 and 2 would maintain or increase habitat for more of the Partners in Flight priority species than would Alternative 3.

Mitigation Common to Action Alternatives

The following are mitigation measures in addition to the Forest Plan standards and guidelines. Mitigation measures identified with a "T" pertain to timber harvesting and an "M" refers to mechanical treatments, "P" refers to pond construction/maintenance, "G" refers to glade restoration, "D" refers to dump removal, "R" refers to roads, and "F" pertain to fire.

Mitigation Measures - Heritage Resources (CR):

CR1 (T, M, P, G, D, R, &F)
Heritage resource sites eligible for inclusion in the National Register of Historic Places (NRHP), as well as sites whose National Register significance has not been evaluated, will be avoided and protected from all project activities. Avoidance of cultural resources will be understood to require the retention of such properties in place and their protection from effects resulting from the undertaking (Memorandum of Understanding between the Mark Twain National Forest and the Missouri State Historic Preservation Officer, June, 1995). Effects will be avoided by: (1) rerouting around sites those roads for which reconstruction is proposed; and (2) establishing buffer zones around those sites in areas where harvest activities will take place. Roads will by-pass sites at a sufficient distance and buffer zones will be of sufficient size to ensure that the integrity of the characteristics and values that contribute, or may contribute, to the properties' significance will not be affected. Site avoidance is the preferred mitigation action pursuant to the Forest Plan, Section IV-30, 31 (also FSM 2361.21[2]).

CR2 (T, M, P, G, D&F)
Discovery of Heritage Resources During Project Implementation: Pursuant to the provisions found in 36 CFR 800.13, should any previously unrecorded heritage resources be discovered during project implementation, activities that may adversely affect that resource will be stopped immediately. A professional archaeologist will evaluate the resource to determine appropriate actions for protecting the resource and for mitigating the adverse effects on the resource. Consultation will be initiated with the Missouri State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation as required. Project activities will not be resumed until the resource is adequately protected and agreed-upon mitigation actions are implemented with SHPO approval.

CR3 (T, M, P, G, D & F)
If sites cannot be avoided by project related activities, test excavations will be conducted at such sites in order to determine their eligibility for listing on the NRHP. For those sites found to be eligible for the NRHP, mitigation plans will be developed in consultation with the Missouri SHPO and the Advisory Council on Historic Preservation. Sites found to not be eligible for the NRHP will not be protected.

CR4 (F)
Mitigation measures recommended for prescribed burning are based on those used for landscape burns conducted elsewhere on the Mark Twain National Forest (Price 1996; 2000a; 2000b) and found to be effective by the monitoring of such burns (Price 1998; 2001). Mitigation measures relating to prescribed burning fall into two categories: fireline construction prior to the burn (CR4) and firing operations (CR5). To ensure that none of the sites in the areas proposed for burning are

damaged by fireline construction, all sites will be identified and flagged ahead of fireline construction. The firelines will then be constructed so as to avoid these sites. There will be no removal of soil or disturbance below the ground surface during fireline cleaning. In the unlikely event that spotting occurs within the site, only hand tools will be used to contain the spots within the site boundaries. If it is deemed necessary to construct fireline through a site due to safety considerations, this line will be constructed using hand tools (leaf blowers, rakes), avoiding all features.

CR5 (F)
There are several basic mitigation measures that may be taken as needed in regards to the prescribed burning firing operations that will help ensure that the mitigations listed below succeed in protecting the sites. These mitigation measures are listed as follows:

1) Some sites contain artifacts or structural material (i.e., wood) that could be damaged or consumed by fire. Because of the presence of these materials, a fire burning through these sites could potentially alter the historic integrity of the sites. To mitigate this potential damage, a set of two parallel hand lines should be constructed around the areas of the sites that could be damaged by fire. These lines should be 30 to 50 ft apart. The area between the hand lines will then be carefully burned to create a fuel-free zone around the combustible material prior to conducting the main burn.
2) Features at some sites are constructed using sandstone or limestone rocks that could be damaged by a high intensity fire. To protect these features, all leaf litter and duff will be removed from the vicinity of the structures using rakes or leaf blowers and all dead woody vegetation in the area will be cut and removed.
3) Those sites requiring pre-burn mitigation will be visited by the burn boss and an archaeologist prior to initiating the burn. Mitigation measures will be discussed during visits to each of these sites. All sites requiring protective actions will be clearly flagged by an archaeologist prior to the burn.
4) A no-drop zone will be established around each of the sites containing combustible material to insure that the sites are not inadvertently damaged by aerial ignition if this method is used. The helicopter crew will be fully briefed on the locations of vulnerable heritage resources and the latitude and longitude of each of the sites in no-drop zones will be provided to the helicopter crew.
5) Those sites with combustible materials and features will be marked prior to the burn with a large orange fabric “X” which will be clearly visible from a helicopter.
6) If sites are present within a particular burn area that are determined by the archaeologist to require special protective actions (such as those sites with combustible material), all personnel involved in the prescribed burning operation will be fully briefed on the presence of archaeological sites and the need to protect sites vulnerable to damage during the burning operation. A member of the Forest Heritage Staff familiar with the burn and the sites will conduct this briefing prior to the burn.
7) Forest Service personnel will be assigned to accompany any non-Forest Service crews and squads used on the burn that will work in areas near vulnerable archaeological sites during ground ignition operations.

Mitigation Measures - Air Quality (A):

A1 (F)
Prescribed burning would be completed during weather conditions that facilitate smoke dispersal. The public would be informed of the planned burning days and the Forest Service employees would control traffic, if needed, along Forest Roads.

Mitigation Measures – Soil and Water (SW):

SW1 (T&M)
Temporary road and main skid trails would be located on the ground by Forest Service personnel prior to harvest operations, avoiding layouts that concentrate runoff into draws, ephemeral drainages, sinkholes or watercourses.

SW2 (T&R)
Proper grade and water control structures would be constructed and maintained on skid trails. Specifications that are indicated in the Missouri Department of Conservation's "Missouri Watershed Protection Practice" would be followed. Roads would not drain directly onto skid trails or into stream channels.

SW3 (T)
When logging is complete additional slash would be pulled onto skid trails.

SW4 (T&R)
Forest Service would suspend skidding during wet periods, when excessive rutting and churning of the soil begins or when runoff from skid trails is turbid and no longer infiltrates within a short distance from the skid trail.

SW5 (F&T)
Prescribed burn units should have as little mechanical disturbance to the soil before and just after burning as possible. Equipment would not use stream channels as "roads." Where stream crossing is unavoidable it would be done in locations that would create the least impact on stream banks and beds.

SW6 (F)
Fire lines created with dozers would not be placed in riparian areas, fens, wetlands, or other sensitive habitats.

SW7 (F&T)
All fire lines would be seeded with a cover crop suited to area objectives and would be fertilized, if necessary, with standard fertilizer immediately after construction or as soon afterwards as to allow the best chance of germination. Water bars would be constructed in accordance with the Missouri Department of Conservation's "Missouri Watershed Protection Practice" to minimize water movement along fire lines.

SW8 (T&M)
Trees anchoring stream banks of any distinct channel would not be cut unless they are species that is known to "sprout" from a cut tree's roots, even if the stream does not require a buffer zone. This includes channels that are the result of road drainage ditches.

SW9 (T&M)
Reconstructed and temporary road constructions, which have potential to cause severe erosion, would have additional water protection mitigations as follows: Temporary roads that cross drainages would be closed as soon after the harvest or treatment as possible. All crossings would be constructed at right angles to the channel at locations chosen to have the least impact as possible on the stream channel and banks. Slash filter would be placed uphill from any drainage and used as filter at the outside of the water-bar nearest the drainage. If the crossing location is soft, it would be reinforced with aggregate.

SW10 (T, M, P, G, D&F)
No mechanical disturbance of the soil would occur on slopes greater than 35%.

SW11 (T, M, P, G, D&F)
Stands with soils that have perched water tables would have little to no mechanical disturbance to wet soil.

SW 12 (T)
A 100-foot no-cut zone will be place around all fens, seeps and springs. A buffer zone of at least 100 feet in radius would be retained in association with seeps, fens, springs, and any other special features or habitats. Skidding and

decking would be prohibited within these buffer zones.

SW 13 (T&F)
There will be a no cut zone of at least 50 feet from the edge of any sinkhole that currently exists within the activity area, or if one develops before the action is initiated. Strips of unburned vegetation will be maintained around sinkholes and long stream corridors to filter and control surface water flow. A buffer of 100 feet will be provided around natural sinkhole ponds. Within this buffer, there will be no commercial harvest of trees, no firewood permits, and no ground-disturbing activity. Prescribed fire would be allowed within the buffer zone.

SW 14 (T)
Log landings, major skid trails, and other areas where mineral soil is exposed would be naturally re-vegetated. If not successful after one growing season, artificial seeding and fertilizing would be done for cover crop only. No invasive, non-native species would be seeded to provide permanent vegetation.

Mitigation Measures - Vegetation (V):

V1 (F)
Prescribed burn plans will incorporate burning conditions that best meet specific management area objectives to reduce fuel loads, stimulate forest regeneration, have minimal impact on future timber resources, meet visual standards, and protect sensitive species. Time of year prescribed burns are conducted will be determined based upon the site-specific objectives and follow guidance in the 5100 Fire Management section of the Forest Plan.

V2 (T & M)
For perennial and intermittent streams, the no cut zone will include the riparian zone as defined by the forest plan, or 50 feet, whichever is greater. Riparian zone includes frequently and occasionally flooded areas.

V3 (T, M, R &F)
A protection zone will be designated around glades. This zone will surround the glade itself, as well as any adjacent grassy areas, rock ledges, exposed bedrock, and/or rock outcrops. Trees, other than post oak and chinquapin oak, may be removed from within this zone, but may only be removed by winching or dragging. No heavy equipment may be used within this zone unless pre-approved by a biologist/ecologist. Removal of small diameter trees, especially red cedar, is encouraged within this zone.

Mitigation Measures - Wildlife (WL):

WL1 (T&M)
Retain a minimum of 15 sq. ft. of basal area in seed tree harvests, and a minimum of 25 sq. ft. of basal area in shelterwood seed cut harvest units, of reserve trees grouped or retained around large snags, large live trees, den trees, and within intermittent drainages to minimize potential for wind throw and provide thermal protection of suitable Indiana bat roost trees. Leave larger, long-lived trees (white oak, post oak, pine or hickory) where opportunities exist. For both cavity trees and snags, retain at least 0.5/ac nineteen inches (19”) dbh or greater in size, if available. Retain at least 4.0/ac 11-18” dbh cavity trees and snags, if available. Retain at least 2.0/ac 10 inches (10”) dbh or less in size cavity trees and snags, if available.

WL2 (T&M)
In all even-aged harvests (seed tree, and shelterwood seed cut), reserve trees should be left in groups of at least 5 or more trees wherever possible. No snags should be left standing alone within the cut area, but rather, should be surrounded by several live trees. In uneven-age

harvests (group selection with improvement cutting), the longer-lived trees (white oak, post oak, hickory, and pine) will be featured leave trees with a range in the diameter distribution. Snags and dens from the red oaks will be left, if available, to meet standards and guidelines.

WL3 (T, P, &M)
In all harvest areas retain all shagbark hickory, shellbark hickory, sycamore, and lightning struck trees (MTNF Biol. Assess. p. 32). Retain, as available and to the maximum extent possible and logistically practical, all unmerchantable dead trees, any existing dead trees >= 20" dbh and any tree >= 26" dbh unless a human safety hazard. Also, retain some (not all) dead or dying trees >= 9" with at least 10% exfoliating/defoliating bark, and most den/cull trees.

WL4 (T&M)
There will be no harvest within 50 feet of a sinkhole or pond.

WL5 (T, M, F, G, P, R &D)
The discovery of a new site occupied by federally listed species within the project area (such as eagle communal night roosts, or Indiana bat maternity sites) at any time during the course of activities described in this EIS, will lead to further consultation with the US Fish and Wildlife Service and development of protective measures as determined necessary for protection of the species and its habitat.

WL6 (T, M, R, P&F)
A buffer zone of at least 100 feet in radius will be retained in association with seeps, fens, springs, and any other special features or habitats (other special features to be determined by a biologist). Temporary road construction, skidding and decking and new dozer line construction will be prohibited within these buffer zones.

WL7 (T)
Any active sharp-shinned and Cooper's hawk nests discovered shall be protected when encountered. Within mature pine stands retain 2 mature pine trees per 5 acres to provide potential nest trees.

WL8 (T&M)
During harvest and reforestation treatments, retain butternut dogwood, serviceberry, walnut and other minor components of the stand, particularly soft and hard mast producers.

WL 9 (T, R &M)
Retain water-holding ruts and puddles where they do not conflict with road maintenance and use activities or create an increased potential for erosion and runoff (MTNF Biol Assess, p. 34)

WL 10 (F)
To avoid adverse impacts to potential maternity sites for Indiana bats, no burning will occur during their maternity season (May 15-August 15).

WL 11 (F)
Prescribed burning activities will be conducted in a manner to ensure that smoke does not accumulate heavily in areas likely to be occupied by Indiana or gray bats. These areas include Silver Mines Recreation Area, and caves known to support gray or Indiana bats.

Mitigation Measures - Visuals (VS):

VS1 (T & M)
"Not more than 10 chains (660') of temporary opening may occur along any 40 chains (0.5 mile) of hiker or horse trail during this plan period. Log landings are prohibited within 100' of a recreation trail. Where skidding across a

recreation trail is unavoidable it will be done at a right angle and at designated locations."

VS2 (T & M)
Slash adjacent to travel ways within a Sensitivity Level (SL) 1 or 2 (including the Audubon Trail) will be lopped and scattered to lie within 30" of the ground. Slash adjacent to travel ways within SL 3 with a Variety Class of A or B will be lopped and scattered to lie within 48" of the ground. No trees along the Audubon Trail would be left across the trail.

VS3 (T&M)
Slash disposal mitigation is specified by stand within contract specifications by Forest Plan regulation. Slash adjacent to travelways where timber harvest activity is occurring would be reduced to lie within 36" of the ground within the near seen area up to a maximum distance of 300' in the Variety Class-B, Sensitivity Level 1 and 48" in the Variety Class - B adjacent to Sensitivity Level 3 roads. In areas having a Visual Quality Objective of Retention and Partial Retention, the negative visual impacts will be mitigated concurrently with or immediately after each phase of activity. Mitigating measures will be completed for each cutting unit before beginning activities in the next sequential block in the same corridor or view shed. The total lapsed time from initiation of activities to completion of obligations specified by a contract or a project prescription shall not exceed one year for any single cutting unit. Emphasis will be placed on completing all work within these areas in a systematic manner within the shortest practical time." (Page IV-31 Forest Plan)

VS4 (T&M)
Harvest edges will be feathered away from the property line where the private land is open, not forested

VS5 (T&M)
All harvest areas will be laid out on the ground in a manner that will reflect natural lines and be visually subordinate to the characteristic landscape. Under Alternative 1, the No Action alternative, there would continue to be of open woods due to low natural soil fertility, natural disturbance (windstorm, insect & disease, etc.) or wildfire. Existing roads would also remain in the area.

Under Alternatives 2 & 3 the proposed timber management would develop or perpetuate open woods conditions in many parts of the project area. Although individual plants (if they exist in the area) might be adversely affected by the burning or harvest (depending on the timing of the activity), habitat would continue to be available for these species. Burning would be done in such a way to encourage growth of native herbaceous plants, including the plants on the RFSS list if they occur on any of the areas. There are many dwellings and outbuildings on the private land and farm practices. It is hard to predict what changes will be made to vegetation on private land in the future.

In Alternative 1, the proportion of mature and old growth forest would increase over time. A large amount of dead/down material would be provided. There would be a variety of vegetation within small openings created by natural tree mortality. Private lands would provide open habitat in the form of grazed fescue pastures.

Live and dying trees and some ground vegetation would be cut or damaged on the harvest areas in Alternatives 2 & 3 and a larger area in alternative 2 would show burned area until spring greenup. However, grasses, forbs, and shrubby vegetation would resprout and recover quickly to cover the ground area. This alternative would not decrease the opportunity for oak/hickory or pine regeneration, nor would it preclude Uneven-aged management in the

stands proposed for thinning. Private lands would provide open habitat in the form of grazed fescue pastures.

Alternatives Considered but Eliminated from Detailed Study

Federal agencies are required by NEPA to rigorously explore and objectively evaluate all reasonable alternatives and to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14). Public comments received in response to the Proposed Action provided suggestions for alternative methods for achieving the purpose and need. Some of these alternatives may have been outside the scope of the project, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary environmental harm. Therefore, a number of alternatives were considered, but dismissed from detailed consideration.

-Proposed Action with Noxious Weed control was not analyzed in detail because the ID team did not want to address herbicide use prior to completion of a Forest-wide herbicide EIS.

-Pure Pine focus was not analyzed because historically, pure pine monocultures do not reflect Missouri ecosystems, and intensive pine management would also likely require herbicide use.

-Uneven aged Management was not analyzed because species composition and stand structure are not appropriate in all stands to be treated.

-Proposed Action with Planting is cost prohibitive and would require herbicide use for control of undesirable competition.

Comparison of Alternatives

The following table is an overview of proposed actions by activities for each alternative.

Table 2-5. Activity Comparison Table

	Alt.1	Alt.2	Alt. 3
Silvicultural Method	**Acres**	**Acres**	**Acres**
Seed Tree	0	850	0
Shelterwood	0	1482	0
Uneven Aged	0	362	0
Sanitation/Thin	0	1971	0
Over-story Removal	0	65	0
Final Harvest	0		0
Reforestation	**Acres**	**Acres**	**Acres**
Natural Regeneration	0	2605	0
Timber Stand Improvement	**Acres**	**Acres**	**Acres**
Crop Tree Release	0	1606	0
Pine Release	0	173	0
Prescribed Fire	Acres	**Acres**	**Acres**
Open woodland development	76	76	0
Hazardous fuel reduction	2603	2603	0
Road Reconstruction	Miles	**Miles**	**Miles**
	0	8.3	0
Non Commercial Treatment	**Acres**	**Acres**	**Acres**
Heavy Felling	850	0	0
Moderate Felling	3819	0	0
Old Growth Designation	**Acres**	**Acres**	**Acres**
New acres designated	1693	1693	0

Table 2-6. Issue Comparison Table

	Alt.1	Alt.2	Alt. 3
Issue A: Regeneration of Shortleaf Pine			
Measure: estimated acres of regeneration	3291	3291	0
Issue B: Insect and Disease Infestation affecting Forest Health			0
Measure: planned acres (ac) of treatment in high risk or low quality stands	2639	2639	
Issue C: Hazardous Fuels Reduction			0
Measure: acres to be treated	2603	2603	
Issue D: Commercial Logging			
Measure #1: acres to be harvested	0	4730	0
Measure #2: acres to be treated without commercial harvest	4669	0	0
Issue E: Roads			
Measure #1: miles constructed	0 40	0 40	0 0
Measure #2: miles closed			
Issue F: Ecosystem Restoration/Biodiversity			0
Measure: acres improved	6069	6162	

This table provides a summary of the effects of implementing each alternative. Information in the table is focused on activities and effects where different levels of effects or outputs can be distinguished quantitatively or qualitatively among alternatives.

Table 2-7. Summary of Effects by Alternative

RESOURCE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Soils	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term productivity of the land.	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term productivity of the land.	Possible negative effects from wildland fires and no road reconstruction.
Water	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term quality of the water.	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term quality of the water.	Possible negative effects from wildland fires and no road reconstruction.
Air	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term or short-term air quality	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes to inherent long-term or short-term air quality.	Possible negative effects from wildland fires. .
Vegetation			
Fire Mgmt	Desired ecosystem restorations would take place, along with site preparation burns resulting in moving toward desired future conditions of wildlife habitats.	Desired ecosystem restorations would take place, along with site preparation burns resulting in moving toward desired future conditions of wildlife habitats.	Restoration of desired habitats and ecosystems would be delayed.
Fuel Loading	Reduction of fuel loading would decrease the potential for large wildland fire within stands treated.	Reduction of fuel loading would decrease the potential for large wildland fire within stands treated.	Increased fuel loading, potential for larger wildland fires.
Composition & Structure	Provides the most diverse under-story and greatest vertical structure. Early successional habitat created.	Provides the most diverse under-story and greatest vertical structure. Early successional habitat created.	Increase of shade intolerant species in the under-story would inhibit growth of desirable seedlings.
Economics			
Timber Sale Revenue	$0	$1,383,053	$0
Total Timber Costs	$973,170	$1,330,065	$300,000
Board Feet Equivalent	11,930 MBF	12,050 MBF	$0
Visuals	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes visuals.	Adherence to FP S&Gs and site-specific mitigation measure would result in no appreciable changes visuals.	Less visually pleasing views due to increase of shade intolerant species in the under-story.
Recreation	In the short-term some areas may not be available for dispersed recreation due to logging operations or prescribed fires. In the long-term many recreation opportunities could be improved as forest diversity increases	In the short-term some areas may not be available for dispersed recreation due to logging operations or prescribed fires. In the long-term many recreation opportunities could be improved as forest diversity increases.	Safety concerns increase for forest users from hazard wildland fires. .
Wildlife	Open areas would decrease, water sources for wildlife would not be created or maintained. Glades and fens could become suppressed by more shade tolerant vegetation.	Stands would move toward the desired future conditions for habitats listed in the FP. No appreciable change to wildlife populations for the long-term.	Stands would move toward the desired future conditions for habitats listed in the FP. No appreciable change to wildlife populations for the long-term.

RESOURCE	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
T&E Species	No additional effects outside those disclosed in the Biological Assessment and Biological Opinion. In compliance with the reasonable and prudent measures of the Biological Opinion.	No additional effects outside those disclosed in the Biological Assessment and Biological Opinion. In compliance with the reasonable and prudent measures of the Biological Opinion.	No additional effects outside those disclosed in the Biological Assessment and Biological Opinion
RFSS Species	May effect but would not likely contribute to a trend towards federal listing or loss of population viability for any RFSS.	May effect but would not likely contribute to a trend towards federal listing or loss of population viability for any RFSS.	No impacts to Regional Foresters Sensitive Species.
Springs, Seeps & Fens	Controlled burning may enhance habitats; potential for adverse impacts to these habitats is low. Best long term because controlled burning would improve habitat quality over the long term.	Habitats may be enhanced by controlled burning; potential for adverse impacts to these habitats is low but higher than Alt. 1	Habitats not enhanced by controlled burning; no measurable potential for adverse impacts to these habitats. Best short term because of lack of controlled burning may reduce habitats quality over the long term.
Riparian areas & Bottomland Hardwood Forest	Habitats may be impacted by controlled burning, tree felling & some ground disturbance, but likely lower levels than Alt. 2.	Habitats may be impacted by controlled burning, tree felling & some ground disturbance; potential for impacts is low but higher than Alt. 1	Habitat likely to be impacted. Best short and long term.
Glades	Habitats enhanced by controlled burning	Habitats enhanced by controlled burning & glade restoration activities. Best short and long term.	No habitat enhancing or disturbing activities; no activities proposed to maintain habitat long-term
Shortleaf Pine Forest	Short term loss of some mature pine; controlled burning; & stand disturbing activities facilitate pine regeneration.	Short term loss of some mature pine; controlled burning; & stand disturbing activities facilitate pine regeneration. Best long term because provides highest levels of activities likely to improve pine sustainability in the log term..	Best in the short term because no loss of existing mature pine habitat in short term; no activities to facilitate pine regeneration in long term.
Fishless Ponds & Temporary Pools	Would increase availability of this habitat in both short and long term.	Would increase availability of this habitat in both short and long term.	Would maintain existing habitats in short term, may decrease availability in long term.

CHAPTER 3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This Chapter summarizes the physical, biological, social, and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in the alternatives chapter. . Specialists considered direct, indirect, and cumulative effects to evaluate both short-term uses and long-term productivity.

The Final Environmental Impact Statement (FEIS) that accompanied the programmatic Forest Plan disclosed the effects, including cumulative effects, of management practices in a forest-wide context. This Draft Environmental Impact Statement for the East Fredericktown project discloses the effects of implementing the proposed action and its alternatives and is tiered to the Mark Twain National Forest - Land and Resource Management Plan FEIS and subsequent amendments.

The Analysis Area boundaries were delineated by the Sub-Management Areas 4.14-4.17, 8.1 and 9.1. The direct and indirect effects would include those identified in the project area and the existing conditions within the MAs boundaries and Landtype Associations.

The cumulative effects to be considered in this analysis, include the areas within the Oak-Pine Hills and Oak-Pine Plains and the watershed boundaries of Castor River, Coldwater Creek , and Saline Creek. These effects were bounded by 1) time; 2) space; 3) site specific proposed actions within compartments and stands as listed in the various action alternatives; 4) non-federal activities (private lands); 5) Forest Plan standards and guidelines, and 6) other projects presently underway in the Sub-Management Areas and associated Landtype Associations and those likely to occur in the future. The cumulative effects of the alternatives upon each resource must be evaluated separately, as the scope of evaluation for each resource is different.

The cumulative effects of the alternatives upon each resource must be evaluated separately, as the scope of evaluation for each resource is different. Cultural resources are evaluated on a site-by-site basis, and then the project is looked at as a whole. Hydrology is looked at from a regional and then local watershed basis. Soils are evaluated on a soil type basis. How large that is would depend on the slope, type of soil and activity. Recreation is evaluated based on use, activity, and travel ways to sites. Visuals are evaluated based on seen area, travel ways, and the VQO of the area. Vegetation is evaluated all the way from an Eco-region of the United States down to the Project and stands level. Biodiversity deals with population trends as a whole and the habitat available here for them. The scope of the analysis may vary by resource, but the following is the cumulative effects of the Oak Decline and Forest Health Project.

The activities identified in Alternatives 1 and 2 (Chapter 1 and 2) are the same or similar to previous activities implemented on the Potosi/Fredericktown Ranger District (See Relationships to Other Documents in Chapter One). Therefore, any effects would be the same or very similar to ones which have already been observed.

VEGETATION - HISTORICAL PERSPECTIVE

The environment of the Missouri Ozarks has changed substantially over the last 12,000 years. Data relating to past environments have come from a variety of sources, including fossil pollen, animal remains, geomorphology, geology, and archaeology. Studies from regions adjacent to the Courtois Hills have provided a wealth of data that pertain to past environments. The following summary of prehistoric environments has been drawn from Delcourt and Delcourt (1994), Delcourt et al. (1999), O'Brien and Wood (1998:108), Royall et al. (1991) and Warren (1992; 1995). By 12,000 years ago, the spruce and boreal jack pine that characterized the height of the last glacial maximum in the Ozarks had given way to an Oak-Ironwood Forest that did not resemble any forest types seen today. Between 12,000 and 8,000 years ago, the climate was characterized as warm and wet and the forest gradually changed to mixed deciduous woodland, also with no real modern analogues. These early-successional species could thrive in the ephemeral and variable weather conditions that existed at that time. From 8,000 to 4,000 years ago the environment changed to a warm and dry period known as the Hypsithermal. Drought tolerant species took over the area and the forest became an Oak-Hickory savanna, characterized by a sparse woodland and grass under-story. The increased temperatures and decreased precipitation had a major impact, with

groundwater tables dropping, increased hill slope erosion, and a decline in the discharge of streams. These effects lead to changes in the distribution and composition of terrestrial and aquatic fauna. Following 4,000 BP (Before Present), the modern Oak-Hickory-Short leaf pine forest developed with the return of warm and wet conditions. Creeks increased in flow and stabilized into their current characteristics of high gradients with shallow water, swift currents, with gravel or sand substrates.

The onset of colonization of Missouri by European immigrants caused rapid, large-scale changes to the environment, and the original healthy ecosystems, to an unprecedented extent that continues today (Yatskievych, 1999). Not only is outright destruction of habitats evident, but also evidence is mounting that the character of existing terrestrial natural communities is affected over time. Missouri's natural vegetation prior to and at the time of settlement was described as a highly varied landscape mosaic of forests, woodlands, savannas, prairies, marshes, glades, rivers, streams, and caves. This landscape was mantled in rich vegetation and abundant wildlife as attested by many early travelers and explorers. They wrote about the bison, elk, deer, beaver, mountain lion, black bear, and wolves seen daily. They saw passenger pigeons, Carolina parakeets, and red-cockaded woodpeckers not seen in Missouri today. Back at the time of settlement, Missouri's native diversity was essentially intact. Continuous, diverse mosaics of complex ecosystems dominated the landscape. Trees grew to immense proportions. Evidence of this past still exists in small-protected remnants called natural areas. Biologically rich natural communities within these natural areas may contain as many as 100 plant species per acre within a forest, woodland, savanna, or prairie.

Following Euro American settlement in the early nineteenth century, substantial environmental changes once again occurred in the region. At first, the bottomland forests were cleared for agriculture, while logging of the uplands soon followed (Wood and O'Brien, 1995:35). From the late nineteenth through early twentieth centuries, logging on a massive scale occurred throughout the Ozarks, resulting in almost complete deforestation of the region. The current project area was logged to provide lumber. After all the merchantable timber was cut, the lands owned by the lumber companies were sold off as farms. Farming proved to be marginal at best in most of these areas and the farmlands were converted to rangeland. In many cases, burning occurred annually to increase forage and this kept the forest from naturally regenerating. The result of all of this activity was a devastated resource base. Soil erosion became a major problem, springs went dry, and wildlife essentially disappeared (Rafferty, 1980:185-186).

Across the landscape, ecosystem or forest health is a function of vigorous renewal or stability (as in the condition prior to settlement). A healthy ecosystem can be resilient to a wide range of disturbances. Missouri's forest evolved under a wide variety of disturbances (Nelson, 1985) including natural and man-made fire; grazing by free-roaming native herbivores; extremes in violent weather such as tornados, ice storms, snow storms, wind, heavy precipitation, drought; insects and fungal diseases. Certain species of oak, hickory, and short leaf pine are disturbance adapted because they are shade intolerant. These require periodic disturbance to get light to the ground or create seedbeds for germination and regeneration. Problems arise (oak mortality, soil loss, exotic species invasions, etc.) when ecosystems are impacted by multiple or repeated extreme stresses such as consecutive years of disease, defoliation, grazing, burning, and drought.

The present forest environment seen in the Ozarks today has developed entirely since the 1930s and the establishment of conservation and forest management in Missouri. Present forest types in many cases differ from those found in pre-settlement times. An excellent

example of this is found in the area around the Nova Scotia Ironworks (1880-1885) in southeastern Dent County. When General Land Office surveys were conducted in 1820, the area was characterized by large mature pine trees (70% of the timber) with an open under-story intermixed with small amounts of black, white, and post oak, with some hickory. In contrast, today the area is dominated by declining black oak (70%) with a dense brushy under-story and small amounts of pine, hickory, and white and post oak (Wettstaed, 1999a; 1999b; Wettstaed and Harpole, 2001; Wettstaed et al., n.d.). Another example is the Sligo Iron Furnace (1880-1921), which was located in eastern Dent County. Thousands of acres of timber were required simply to provide charcoal to the Sligo furnace. Sturdevant (1980:46) reported that an average of 5,000 acres a year was harvested for charcoal. There were 72 kilns located at the Sligo plant to produce charcoal from this wood. Much of this area was originally forested by pine. Archaeological evidence to support this was recovered by investigations at the Rulon Depot (23IR145) the eastern terminus of the Sligo and Eastern Railroad (Wettstaed, 1997). A crosscut saw of the type used to cut pine was recovered at this site. Today the area is dominated by oak. In many cases the forests seen in the Ozarks today are much different than those that existed 150 years ago.

Today, virtually all of Missouri's original 12 million acres of prairie are gone forever (Schroeder, 1981). Thousands of miles of original meandering streams and rivers are captured in man-made channels and levees. Virtually all of Missouri's timber has been logged at least once. The Ozarks logging boom began in 1887 with the advent of railroad construction. Production peaked in 1899 when Missouri sawmills produced 724 million board feet. Most of the state's original quality timber was gone by 1920. This resulted in a drastic decline in pine-dominated forests and woodlands. Cunningham and Hauser (1992) estimated that short leaf pine was reduced from 6.6 million acres prior to 1880 to less than 400,000 acres today.

The result of this boom period, coupled with extended decades of open-range grazing and subsequent severe soil erosion from cultivation and overgrazing, left the Ozarks with an abundance of fast-growing, shade-intolerant pioneer scarlet, black, and northern red oak that replaced white oak, post oak, and short leaf pine. This greatly reduced and altered the pre-settlement forest's unique vegetation composition and soil productivity. A healthy, sustainable Ozark forest or woodland ecosystem at the time of settlement contained a rich herbaceous grass cover, shrubs, ferns and tree seedlings.

Research on oak mortality strongly correlates the decline of scarlet and black oak with droughty, clayey, cherty Captina and Clarksville soils (Law and Gott, 1987). Both soils likely suffered severe erosion loss of original A and B-horizons. Trees establishing themselves in poor, clayey or rocky eroded soils would be especially susceptible. Further, trees of similar age, growing together, display similar group behavior. Decline results. Subsequently, further analysis is showing that white oak, post oak, and short leaf pine (among other species) are increasing in relative abundance in the declining stands. These species, having been the dominant trees prior to settlement, are better adapted to surviving periods of drought.

Vegetation - Trends

Current studies in classification of native vegetation reveal that much of the oak-hickory forest in pre-settlement times was much more open in character with perhaps one-third in savanna, one-third in woodland and the remaining third in forest (Nelson, 1985). Oak-pine forest is the second most extensive within the region, with 4.4 million acres. Pine forests were in fact very open in

character and produced tremendous amounts of lumber at the time of settlement.
Non-industrial private forest owners hold 68 % of the 22.89 million acres of timberland in the Ouachita-Ozark Highlands Assessment area; forest industry owns 11%. Thus, non-industrial, private and corporate landowners together hold more than 79% of the timberland. The remaining 21% consists of public timberlands, three-fourths of which are within three national forests. Since the 1970's, forested areas have increased in five of the six survey regions in the Highlands (Forest Inventory and Analysis). This dramatic increase in forest is partly attributed to the suppression of fires and cessation of woodland grazing as former rangeland lost its productivity.

Vegetation - Fire Management

Wildland fire is among the oldest of natural phenomena. Wildland fires, whether lightning caused or set by humans, trace their ancestry to the early development of terrestrial vegetation. Hardly any plant community in the temperate zone has escaped fire's selective action. Many biotas have consequently so adapted themselves to fire that such adaptations have become symbiotic (Pyne, 1982). Missouri is no exception. Natural and man-made fires were and are clearly evident across the landscape. Trees bear fire scars dating back hundreds of years. Early explorers wrote about the numerous fires set by Indians. Even today's remaining natural vegetation and wildlife alludes to the importance of fire. From an ecological and natural resource management perspective fire is treated as one of many factors in the environment comparing with rainfall, tornados, and drought. The effects can be beneficial and destructive. The challenge is to safely apply fire in a way that achieves and benefits resources on the Mark Twain National Forest, and at the same time protects other human values.

Before fire prevention and suppression became common, an Ozark forest typically had fewer trees that were spaced much farther apart than today's stands. Fire was a natural factor to which many species and ecosystems have adapted (Pell, 1999). Many ecologists (Bielman and Brenner, 1951; Ladd, 1991) have emphasized the importance of fire as a landscape process in the Ozark Highlands. Native Americans have constantly influenced plant communities and ecosystems throughout North America and the Ozark Highlands for thousands of years, especially through their widespread broadcasting of fire that burned across the land. Lightning fires were added ignition sources. Such fires have resulted in the occurrence of fire-dependent prairies, savannas, and woodlands throughout the Ozarks (Ladd, 1991).

Fire suppression from the time of settlement to the 21st century has resulted in degradation and loss of species diversity in savannas and open oak woodlands. Additionally, overgrazing removed much of the original savanna and woodland ground flora and caused increased soil erosion. Subsequent clear cutting of Missouri's virgin timber allowed a second growth release of many young oaks, hickories, and other tree species. In the absence of fire, this new tree growth permitted excessive fuel leaf litter to accumulate that smothered what ground cover flora still existed.

Studies indicate that extensive areas within the project area are classified Fire Condition Class 2, and to a lesser amount, Condition Class 3. The "condition class" is a risk descriptor associated with alteration of fire regimes. Condition Class 2 develops when one or more fire intervals are missed (often as a result of fire suppression efforts) and the understory vegetation becomes denser. The accumulated understory tends to burn more intensely, increasing the difficulty in suppressing a fire and resulting in a more pronounced impact on

biodiversity, soil productivity, and water quality.

In Condition Class 3, fires are relatively high risk and the fire intensity is more severe, impacting large trees that normally would survive fires of lower intensity. This condition class is high risk based on the danger posed to people and the potential for long-term resource damage.

Many dense pine stands scattered across the project area consist of 30- to 60-year-old, overcrowded stands where tree canopies interconnect. Trees in these conditions tend to be weakened by the competition for available growing space and become more susceptible to disease, insects, wildfire, and drought. Many of these stands are characterized by overcrowding and by weakened, dying, or dead trees that provide elevated fuel loads for wildfires. The current fuel types, loading, and density on the selected project stands are conducive to stand-replacing fires. Stand replacing fires are wildfires that burn intensely under adverse weather conditions and in accumulated fuels, thereby fundamentally changing the vegetative composition of the ecosystem, destroying communities and/or habitat, or entire stands.

When looked at on the community level, fire carries out several functions essential to the perpetuation of many ecosystems. For example, fire is known to (1) prepare seedbeds, (2) increase species richness and cover, (3) influence the mosaic of age classes and vegetation types, (4) control plant community composition, (5) regulate the amount and type of fuel accumulation, (6) recycle nutrients, (7) increase or decrease forest insects and disease problems, and (8) directly influence wildlife habitat (Kilgore, 1973; Parmeter, 1977; Heinselman, 1978). The initial response after fire is for oak and pine regeneration to occur, ground cover species to increase in abundance, richness, and cover, and wildlife to increase as a result.

VEGETATION - EXISTING CONDITION OF STRUCTURE AND COMPOSITION

Primary tree species commonly found in the Analysis Area include: black, scarlet, white and post oak, shortleaf pine, and various hickories. Primary forest types include short- leaf pine, black oak, scarlet oak, mixed oak and a mix of oak and pine. Because of the extensive logging that occurred in the early 1900's, most trees in the stands are the same age (even-aged), mature or over-mature.
Stand structure is a combination of over-story (tree size classes) and under-story conditions. Oak decline over the last twenty years has created holes in the over-story that have allowed an under-story of advanced oak, pine and hickory regeneration to become established in many stands. Fire control has also allowed under-stories of species such as dogwood, red maple and sassafras to become established on some of the better sites. Horizontal diversity, or diversity across the landscape, is a result of the spacing of forested and open stands and the different age classes. Timber harvesting, rights-of-way, trails, and natural openings create gaps in the forest canopy, which also contribute to the horizontal diversity. The majority of the Analysis Area is continuous, mature forest. Besides forested land, permanent openings, including rights-of-way, make up less than 1% of the national forest ownership and generally consist of lowland or upland shrubs, and grasses. Permanent openings needed by wildlife for a variety of reasons and are a key component of a diverse landscape in a healthy forest ecosystem are lacking. Forested stands that have been recently regeneration harvested (clearcuts/seedtree cuts) are called temporary openings, and are typically between 0-9 years old. Currently, 455 acres (2.6%) of NFS land in the analysis area meet this criteria.

Timber stands that are predominantly black and scarlet oak in excess of 70 years of age account for 14% (approximately 2,495 acres) of the national forest land in the Analysis Area. Field surveys and prescriptions conducted during the planning stage of this project verified that these stands are suffering from moderate to severe oak decline as a result of relatively old age (70+ years), shallow rocky soils, and continued severe droughts. Secondary factors that cause further stress and damage to these trees are red oak borers, chestnut borers, Armillaria root rot, and Hypoxylon canker.

An additional 15% (approximately 2,614 acres) of the Analysis Area is in mixed oak and oak-pine forest types over 70 years of age. The black and scarlet oak component in these stands range from 30% to 80% of the stand composition and are the trees experiencing moderate to severe oak decline.

An additional 2,440 acres (14%) of the black and scarlet oak forest type and 2,141 acres (12%) of the mixed oak and oak/pine forest type is between the ages of 50 and 69 and is showing early symptoms of decline. Total acres being affected or with the immediate potential to be affected by oak decline is 9,690, 56% of the project area.

Tables V-1 thru 5 displays the horizontal diversity found across the Analysis Area on NFS.

Table V-1: Horizontal Diversity (Age Class) by Forest Type for M.A. 4.14

FOREST TYPE	ACRES					
	NON-STOCKED	SEEDLING (0-9)	SAPLING/POLE (10-49)	SMALL ST (50-69)	MATURE (70-99)	OVER MATURE (100+)
Shortleaf pine/Cedar		17	141	41	41	0
Black/Scarlet oak		42	489	671	619	0
Mixed Oak/Oak-Pine		95	352	413	365	0
White/Post Oak		0	78	308	123	0
Misc. Hardwood		0	0	0	0	0
Open/semi-Open	24					

Table V-2: Horizontal Diversity (Age Class) by Forest Type for M.A. 4.15

FOREST TYPE	ACRES					
	NON-STOCKED	SEEDLING (0-9)	SAPLING/POLE (10-49)	SMALL ST (50-69)	MATURE (70-99)	OVER MATURE (100+)
Shortleaf pine/Cedar		39	1174	62	0	0
Black/Scarlet oak		66	60	510	424	16
Mixed Oak/Oak-Pine		25	606	393	563	27
White/Post Oak		0	67	70	148	103
Misc. Hardwood		0	0	6	0	0
Open/semi-Open	49					

Table V-3: Horizontal Diversity (Age Class) by Forest Type for M.A. 4.16

FOREST TYPE	ACRES					
	NON-STOCKED	SEEDLING (0-9)	SAPLING/POLE (10-49)	SMALL ST (50-69)	MATURE (70-99)	OVER MATURE (100+)
Shortleaf pine/Cedar		0	85	66	24	0
Black/Scarlet oak		0	211	721	516	24
Mixed Oak/Oak-Pine		57	485	873	487	236
White/Post Oak		0	18	69	13	56
Misc. Hardwood		0	13	56	33	110
Open/semi-Open	2					

Table V-4: Horizontal Diversity (Age Class) by Forest Type for M.A. 4.17

FOREST TYPE	ACRES					
	NON-STOCKED	SEEDLING (0-9)	SAPLING/POLE (10-49)	SMALL ST (50-69)	MATURE (70-99)	OVER MATURE (100+)
Shortleaf pine/Cedar		0	468	154	0	8
Black/Scarlet oak		114	131	538	705	191
Mixed Oak/Oak-Pine		0	806	462	643	293
White/Post Oak		0	40	43	114	105
Misc. Hardwood		0	0	0	101	0
Open/semi-Open	23					

Table V-5: Horizontal Diversity (Age Class) by Forest Type for the Analysis Area

FOREST TYPE	ACRES					
	NON-STOCKED	SEEDLING (0-9)	SAPLING/POLE (10-49)	SMALL ST (50-69)	MATURE (70-99)	OVER MATURE (100+)
Shortleaf pine/Cedar		56	1868	323	65	8
Black/Scarlet oak		222	891	2440	2264	231
Mixed Oak/Oak-Pine		177	2249	2141	2058	556
White/Post Oak		0	203	490	398	264
Misc. Hardwood		0	13	62	134	110
Open/semi-Open	98					

Environmental Effects Common to Action

Alternatives 1 and 2

All types of harvesting remove the main portion or bole of the tree from the site. Tops of trees are traditionally left on the site,

increasing the dead and down material component in the short term. Since most of the nutrients in the trees are in the leaves, twigs, and small branches, there would only be minor effects on nutrient cycling and soil fertility. Most snags would be retained.

Reforestation and restoration treatments proposed under all action alternatives have similar implications. In a healthy, sustainable forest ecosystem, tree seedlings, herbaceous vegetation, and shrubs develop naturally whenever suitable light conditions are created on the forest floor. When over-story trees die, young tree seedlings replace them, helping to ensure that a forested condition is maintained. The proposed treatments would be implemented to allow suitable light conditions to promote the development of desired tree seedlings, herbaceous vegetation, and shrubs. The amounts of these proposed treatments are displayed by alternative in Table V-6, and are dependent on the amount of even-aged and uneven-aged regeneration proposed. The following is a discussion of the anticipated vegetative effects for each of these types of treatments.

Table V-6: Proposed Reforestation Activities by Action Alternative (acres)

Activity	Alternative 1	Alternative 2
Prescribed Fire	**2,603 ac**	**2,603 ac**
Natural Site Preparation	**4,669 ac**	**2,605 ac**
Total Acres	**7,272 ac**	**5,208 ac**

Prescribed fire is proposed in stands to reduce hazardous fuels. A companion benefit would be the establishment of new tree seedlings to perpetuate well stocked forest cover and to increase the shortleaf pine component in the stands that are burned.

Site preparation would be completed on many sites proposed for either even-aged or uneven-aged regeneration. Conducted following seedtree, shelterwood and some improvement cuts, this treatment would encourage sprouting of desired species and involve cutting poorly formed, suppressed or severely damaged trees that may interfere with development and growth of the desired species. Trees specially designated for retention on the site would not be cut. Cutting undesirable species such as red maple, and sassafras will not eliminate them from treated stands since most stumps will produce sprouts. Cutting these trees will primarily reduce their stature, shading and competitive advantage over commercially desired oak, hickory and shortleaf pine reproduction. It is estimated that approximately 20% (72 acres) of the UEAM acres proposed in Alternative 2 would actually be affected by this treatment. Although the Alternative 1 Table does not reflect the 4,755 acres of natural site preparation shown in Table V-6, the effect would be the same after the heavy to moderate mechanical work was completed.

Table V-7: Proposed Timber Stand Improvement Activities by Action Alternative (acres)

Activity	Alternative 1	Alternative 2
Crop Tree Release	**0 ac**	**1,606 ac**
Pine Release	**0 ac**	**173 ac**
Total Acres	**0 ac**	**1,779 ac**

Crop tree release treatments proposed for Alternative 2 involve the non-commercial mechanical hand cutting of woody vegetation that interferes with the tree saplings (either naturally occurring or planted) on the site. This treatment can be used to direct stand development and to regulate species composition to those best suited for the site or to maintain species diversity. Desirable species include shortleaf pine, white oak, black oak, scarlet oak, hickory and post oak. This treatment can concentrate future growth on the best trees and ensure survival of desired species which otherwise would be at risk of being suppressed or killed by the dominate species that out-compete them. Release potentially increases species richness on the site and is expected to improve tree species composition in the long term.

Crop Tree Release generally is carried out in young mixed oak stands when they are between 12 and 30 years of age, depending upon site-specific stand development patterns and weather conditions. Crop Tree Release work helps ensure a desired composition in young forested stands as well as the development of healthy conditions. This early manipulation of composition will help to alleviate the problems we see in stands that developed on their own into mostly uniform stands of black and scarlet oak.

Pine release treatments involve the mechanical cutting of non-commercial woody vegetation that interferes with pine tree seedlings on the site. The treatment can be used to manage stand development and to regulate species composition to those best suited for the site or treatment to maintain species diversity. Release can promote growth and survival of desired individuals and species which otherwise would be at risk of being suppressed or killed by their competitors. Release potentially increases species richness on the site and is expected to improve tree species composition and stand vigor in the long term.

Release generally is carried out in regenerating pine stands when they are between 5 and 10 years of age, depending upon site specific stand development patterns and weather conditions. Release work helps ensure the survival of pine, which is a desired tree species for south and west facing stands (ELT 17) that otherwise would contain high percentages of black and scarlet oak which would later be predisposed to decline.

Direct and Indirect Effects On Vegetation

Common silvicultural terms are used here in an effort to describe what the end result of stand treatment for will look like after the treatment is complete. The term applied to each individual stand to be treated was based on the current composition as the primary trees to be removed in all treatments will be black and scarlet oak. For example, if the existing stand has greater than 60-70% of trees in the red oak group, that stand will treated as a seed tree or shelterwood cut. If the existing stand has less than 50% of its trees in the red oak group, that stand would be treated as a sanitation or uneven aged cut. Some white oak and shortleaf pine will be designated as needed to reduce canopy cover as required for the regeneration of desired species to create a mix more resistant to oak decline. Some low quality white and post oak (forked/crooked trees) may also be removed to allow the resulting growing space be utilized by other trees. In any event, it is estimated that most of the trees harvested will be black and scarlet oak.

Even-Aged Management Activities

What follows are descriptions of the various harvest methods involved in conducting even-aged management (EAM). The long-term,

forest-wide effect of even-aged silviculture on vegetative patterns is to create horizontal diversity, which results from differences in the vegetative ages and sizes between stands of timber. With implementation of activities identified in the Forest Plan one would encounter a mosaic of seedling, sapling, pole size timber, sawtimber, and old growth stands across the landscape (Forest Plan, Appendix D). This vegetative mix also contributes to a sustainable forest ecosystem.

Heavy Mechanical treatments in **Alternative 1** and **Seed Tree** cuts in **Alternative 2** are proposed on 850 acres.

A seed tree cut treatment is used on sites where it is desirable to have large trees scattered throughout the stand while establishing a new fully stocked stand of oaks and pines. Purposefully creating these open conditions will help stop the trend of conversion to red maple, gum, dogwood or other shade tolerant species by creating the light conditions necessary for the existing oak reproduction to develop, or pine to establish. Developing a lightly stocked over-story of superior trees that will maintain excellent growth rates due to low competition and have the potential to develop into trees of larger size than normally found on these sites under fully forested conditions. The residual over-story will consist mostly of trees with a life expectancy of 20 years or greater. If oak, white oak will comprise the over-story remaining after the timber harvest due to white oak's longer life expectancy. If pine, the trees will be of good to superior quality, suitable for a seed source and capable of adding growth. Harvesting high risk and low quality trees, trees with inadequate growing space, and other trees not needed for the seed tree retention will be the treatment. This treatment also encourages a great variety of early successional plants to meet wildlife habitat needs in the form of temporary forage which is a primary need in this area (Forest Plan, Appendix D). It also promotes large tree crowns on healthy, fast growing trees with the potential to produce more acorns and pinecones.

Residual trees will average above 20 basal area, but below 30% stocking level, thus allowing plenty of growing space. Follow-up treatment after the timber sale will include cutting non-commercial stems, including some of the maples. It may also include sale of round wood and fire wood sales. If present, 5 live cull trees over 12 inches DBH will be left per acre, along with all non-merchantable dead trees (B.O.1999).

Moderate Mechanical treatments in **Alternative 1** and **Shelterwood** cuts in **Alternative 2** are proposed on 1,482.

A shelterwood cut treatment is used on sites where it is desirable to maintain a broken canopy of large trees while establishing a fully stocked new stand of shade intolerant trees. Crown gaps will be the rule rather than the exception. Purposefully creating these openings will help arrest the trend of conversion to shade tolerant species by creating the light conditions necessary for the existing oak advance reproduction to develop. Develop a moderately stocked over-story of good trees that will maintain excellent growth rates due to low competition and have the potential to develop into trees of larger size than normally found on these sites under fully stocked conditions. The residual over-story will consist mostly of trees with a life expectancy of 20 years or greater. White oak will become more abundant currently exist in stands that are presently in mature or over-mature condition since most of the regenerating, healthy, younger trees are white oaks, and they have a longer life expectancy. Harvesting high risk and low quality trees, trees with inadequate growing space, and other trees not needed for the shelterwood retention will be the treatment.

Residual stocking will average below 50% for the site, thus the residual sawtimber will not fully utilize the available growing space. Stocking will average above 30%, favoring thrifty young sawtimber as leave trees.

Follow-up of the sawtimber sale will include cutting of most non-commercial stems. It may also include sales of round wood products. If present, 5 live cull trees over 12 inches DBH will be left per acre along with all non-merchantable dead trees.

Over-story removal cuts are proposed on 65 acres under Alternatives 2.
An over-story removal cut treatment is used on sites where there has been acceptable regeneration resulting from preceding, oak decline, wildfire, or shelterwood cuts, the removal of some or all of the remaining over-story trees that will inhibit the new stand's proper growth and development can be carried out. Reserve trees will be longer-lived pine or white oak, if available, to meet wildlife needs for mast and cover. Additional work will be made in this harvest to continue development of the new age class of shade intolerant species. The residual over-story will consist mostly of trees with a life expectancy of 20 years or greater and will average below 30% stocking, thus allowing the regenerating stand to fully utilize the site's resources, as well as increase oxygen production and carbon dioxide absorption by maintaining a high percentage of the growing space in healthy, actively growing trees.
Reserve trees in excess of the 5 live trees/acre over 12 inches DBH will be removed, as well as trees seriously damaged during logging.

Moderate Mechanical treatments in **Alternative 1** and **Thinning/Sanitation** cuts in Alternative 2 are proposed on 1,971 acres.
Thinning and sanitation cuts are designed to harvest trees that are of poor quality, at risk of dying during the next 5 to 10 years, and to reduce stocking in overly-dense stands to enhance residual tree survival, health and growth. This will also maintain fast growth on the best trees to avoid stagnation, insect and disease problems and promote larger diameter trees in a shorter time frame. Opening up the stands will maintain or encourage a forage component in the stand by allowing light to reach the ground. This will also stimulate under-story development. The visual characteristics will be enhanced in the stand by promoting larger trees. Promoting larger tree crowns will increase seed and mast production on residual trees.

Leaving the best-formed, healthiest and youngest trees in the dominant size class in the stand for future growth will be the practice in these stands. Removing the high risk and poor quality trees will be the objective (red oak group). Some healthy appearing trees may be cut to provide additional growing space for trees nearby. The trees that remain following harvest would consist primarily of larger diameter trees with healthy crowns and adequate growing space.
Uneven-aged Management (UAM) Activities

Moderate Mechanical treatments in **Alternative 1** and **Uneven aged** management methods in **Alternative 2** are proposed on 362 acres.

Uneven-aged treatments are designed to move the stand in a direction of having three or more 20-year age classes developed within the stand. With an uneven-aged system, a portion of each stand must be harvested on a routine cutting cycle such as 15 to 20 years. The remaining stands will consist mostly of trees with a life expectancy of another 20 years or more. White oak will become more prevalent because of its longer life expectancy; white oaks also tolerate more shade than red oaks, and will accumulate in relatively greater numbers in the younger age classes. In this first entry we propose to remove most of the red oak group because of its high-risk condition, while keeping residual stocking above 50% of maximum stocking for the site. (Over-story stocking will generally be capable of utilizing the site resources, except in openings). This will create conditions to favor development of a new age class of shade intolerant tree species including oaks, hickories and shortleaf pine and reduce the trend of conversion to shade tolerant species using a

combination of individual tree selection and group selection as necessary. (See Stambaugh, 2001; Larson, et al., 1999; Larson, et al., 1997)

This treatment will also maintain and encourage a forage component in the stand by increasing light to the ground. Increase the potential for mast production by promoting larger tree crowns on younger trees with more fruiting potential. Maintain or develop fast growth on best trees to avoid stagnation, insect and disease problems and promote larger diameter trees in a shorter time frame.

Uneven-aged management is the application of a combination of actions needed to simultaneously maintain continuous high-forest cover, continual or periodic regeneration of desirable species to develop and maintain at least three age classes, and the orderly growth and development of trees through a range of diameter and age classes. The use of UAM, as well as the other silvicultural treatments, is based on the vegetative composition and biological capability of the sites. Cutting methods that develop and maintain uneven-aged stands are single tree selection and group selection. Both methods would usually be applied concurrently in the Analysis Areas. This combination of the two distinct UAM methods has been termed "Selection with Groups" on the Mark Twain National Forest.

Prescribed Burning/Savanna Maintenance

Prescribed burns are proposed for savanna development on 76 acres for hazardous fuel reduction on 2603 acres under Alternatives 1 and 2. Savanna maintenance is designed to provide permanent semi-open wildlife habitat. The treatment would consist of low intensity dormant season prescribed burns to reduce the density of woody species in the understory. The area would be burned on a 3-4 cycle and over time, trees less than 4" in diameter would be top killed allowing a grass and forb ground cover to become established. Scattered overstory trees may also be killed which would allow light to reach the ground, adding to forage establishment. A one time thinning treatment may be applied if burning alone does not reduce the overstory density to the desired level (30%-60%).

The hazardous fuel prescribed burns would also be done during the dormant season and of low intensity. This would be a one time burn with the primary objective to consume years of accumulated leaf litter and down woody debris under controlled conditions, thus reducing the impact of or aiding in the control of a more intense wildfire in the area. Companion benefits would include improved wildlife habitat in the area from the flush of grasses and forbs that follow burning and an increase in shortleaf pine regeneration in both harvested and other stands by exposing some mineral soil for pine seedfall.

Effects of Mechanical Felling Treatments

In **Alternative 1** stands would be treated by felling to promote regeneration of mixed oak and pine. If feasible, some areas may be mechanically mulched to reduce slash left by felling operations. After the mechanical treatment, stands will resemble harvests that have been prescribed in Alternatives 2. Stands with heavy mechanical treatment will appear the same as seed tree harvests. Moderate felling will be similar to shelterwood/thinning harvests. This alternative would work to restore the forest to a more suitable species composition, stocking level and age class distribution without a commercial harvest.
Cumulative Effects on Vegetation

Cumulative Effects on Vegetation

Under **Alternative 3**, no vegetative management would take place. Thirtyfive percent (35%) of the Analysis Area is currently over 70 years old and an additional Thirtyone percent (31%) is over 50 years old. In the short term, during the next planning decade, these stands would continue to mature and remain high risk or low quality. The stands that are made up of trees in the red oak family would change greatly as the over-story and mid-story oaks continue to die out and are replaced in the under-story by more shortleaf pine and white oak due to the lack of stump sprouting. This will result in a lower percentage of black and scarlet oak than currently exists. This change will be less pronounced on north and east facing slopes and in other stands currently dominated by shortleaf pine and white or post oak.

In the short term (within the next 10 years), implementation of **Alternative 3** would maintain the current species composition in stands less than 70 years old or that are mostly shortleaf pine or white oak species. Over the long-term, species composition would depend on available seed trees and the amount of natural disturbance (openings in the canopy caused by mortality, wind or ice storms, or wildland fire). Age-class distribution would tend to become further skewed towards the older age-classes since no new age-classes are being created except in stands suffering from extreme oak decline. It is estimated that annually 2% of these stands will die back to the extent that they will regenerate themselves naturally, but will be lacking any dominant black and scarlet oak component.
Alternatives 1 and 2 propose various combinations of vegetative treatments which include seed tree cuts, shelterwood cuts, over-story removal cuts as well as intermediate harvests, such as sanitation and thinnings, selection harvesting or mechanical felling. Table V-4 illustrates the treatment of these high-risk and low quality stands by alternative. A look at just two age classes serves to explain what could happen in the Analysis Area based on these treatments.
By examining the age-class 0-9, we can evaluate how alternatives effect regeneration. The 0-9 age-class is an important milestone, it means vertical diversity has gone from the maximum to the minimum. By looking at the effects of the various alternatives on the mature age class (stands 70 years and older), we can gauge the projected percentage of stands in or entering in the phase of decline and mortality, another important milestone, especially for commercial forest outputs ***or forest sustainability.***.

The effects of treatments specified in **Alternatives 1 and 2** would be to increase the 0-9 year age class for the next decade (2003-2012) over and above the estimated 2% that will occur naturally. In 2003, the 0-9-age class on federal land is 2.6% of the Analysis Area. In 2012, estimated acres in the 0-9 age class will equal the acres that have regeneration harvests proposed in this project (seedtree and shelterwood cuts, 20% in UEAM cuts). For **Alternative 1 and 2** the amount is 13%; **Alternative 3** results in 0%. If all even-aged management activities were proposed, with an average rotation age of 70 years, approximately 14% of the area would have a regeneration harvest every 10 years and fall within the 0-9 age class.

In 2003, the mature, high risk, and low quality stand condition classes make up 30% of the Analysis Area. By 2012, trees that are presently 60-69 years old (20%) will have grown into this mature condition class. The change in mature forest by 2012 equals the present condition (30%), plus the acres of trees growing to maturity (20%), minus acres of trees that have been regeneration harvested (0-9 age class). For **Alternative 1 and 2** the calculation is: Mature/Over-Mature Age Class = 30% + 20% - 13% = 37%. For **Alternative 3**, it changes to 50% of the Analysis Area.

Alternatives 2 would enhance both the horizontal and vertical diversity in the Analysis Area through proposed harvesting, reforestation, and wildlife habitat improvement activities. **Alternative 1** would accomplish much of the same, without commercial harvesting of forest products (other than firewood). Vertical diversity would be enhanced by seedling and saplings growing up in the canopy gaps created as a result of individual tree removal. These activities would create a mix of age-classes. Stands receiving treatments in either of the action alternatives would have improved vigor and be more resilient to disturbance. The harvested areas in **Alternative 2** would contribute to a sustainable flow of forest products from the area.

Activities in **Alternatives 1 and 2** that create age-class and species diversity would result in healthier, more productive stands and would promote sustainability of the forest.

Table V-8: Treatment Method by Stand Condition in each Alternative

	Acres: High Risk				Acres: Low Quality			Totals	
	ST	**SW**	**UAM/OSR/SAN**		**ST**	**SW**	**UAM/OSR/SAM**	**High Risk**	**Low Quality**
Alt 1	579	417	154		223	601	416	1,150	1,240
Alt 2	579	417	154		223	601	416	1,150	1,240

ST - seed tree (heavy mechanical under Alternative 1)
SW – shelterwood (moderate mechanical under Alternative 1)
UAM –uneven-aged (moderate mechanical under Alternative 1)
OSR - over-story removal (no treatments under Alternative 1)
SAN - sanitation/thin (moderate mechanical under Alternative 1)

Similar treatments have occurred to the west of this analysis area as part of the Twelve Mile Decision that was signed on 09/08/95 and the Marble Creek Decision signed on 09/15/97. Approximately 6,300 acres of harvesting by methods similar to those described in this document have occurred since that time from those analysis areas.

As a result of a tornado event in April of 2002, 763 acres of blow down trees have been salvaged logged in the last year, 28 acres in the southeast portion of the analysis area and the remainder to the west.

Timber harvesting has also occurred on private lands in and adjacent to the project area and can be expected to continue.

ECONOMICS - EXISTING CONDITION OF ECONOMICS

The Ouachita Ozarks Highland Assessment (OOHA) area (includes the Mark Twain National Forest) accounts for approximately 2.4% of the total United States output of forest products. The forest products industry is 5% of the industrial output, 3% of the employment and 3% of the employee compensation directly attributable in the OOHA area. Thirty-five of the 107 OOHA counties had at least double the average percentage output, employment, and/or employment compensation from the forest

products industry. These counties derived an average 16% of their output, 8% of their employment, and 11% of their employment compensation from the forest products industry. The national forests influence about 1% of the Highlands' overall employment (1.9 million jobs). Of the three principal national forest programs affecting the Highlands' economy (timber, minerals and recreation), timber has the greatest overall influence on employment, employee compensation, and total income when all three forests are considered together.

Jobs and income in Madison and surrounding Counties are affected by management activities on the Mark Twain National Forest through direct employment in mining, guiding services, timber harvest, campground concession, forest regeneration and timber stand improvement contracts, as well as needed products and services that are generated from these activities and recreation activities on National Forest system lands. Priced commodities (revenues) from the East Fredericktown project would be timber sale receipts. The main non-priced benefits include dispersed recreation opportunities such as hunting, fishing, hiking, horseback riding, wildlife viewing, berry picking and so on.
Recreation is a major activity on the Fredericktown District, with a wide range of settings available for recreation from semi-primitive to motorized developed recreation areas. Many areas across the Forest receive very low use indicating that the supply of places to recreate exceeds the demand. Most recreation use occurs at the developed recreation sites such campgrounds, trails and boat launches. The nature of dispersed recreation is that it is flexible, based on the needs of the user and the characteristics of a piece of land at a given time. The visitor has the opportunity to choose and enjoy a wide variety of recreation experiences on the Mark Twain National Forest - an opportunity not duplicated on many other public lands. Non-local recreation users of the Analysis Area contribute to the local economy as they pass through or stay overnight in the area. Forest related recreation activities in Missouri, from the National Hunting, Fishing and Wildlife Survey conducted by the US Fish and Wildlife Survey, has contributed approximately 32.8 million in sales and 67.3 million in business activity annually in the state.
This analysis focuses on incremental economic differences between the alternatives. The analysis includes only variable costs associated with the alternatives. Since fixed costs, such as general administration and program management, do not change among alternatives, these costs are not included. Furthermore, the costs included in the economic analysis are only those to be incurred by the Forest Service. Costs incurred by timber purchasers or other parties are not included. The estimates are based on historical costs for similar projects on the MTNF.

ECONOMICS ENVIRONMENTAL CONSEQUENCES

This project identified the need to perpetuate and maintain the health and vigor of the oak-hickory and oak-pine forest types and salvage dead, dying and high-risk hardwood tree species. With implementation of **Alternative 3,** no vegetative treatments would be carried out. A future increase in the economic value of the timber resource would be lost because of the mortality and degrading of the wood in the trees. For the black and scarlet oak species, oak decline would continue to occur due to years of drought, growing on poor sites, the mature and over-mature condition of the forest. In addition, the infestation of declining trees by insects and disease would threaten the future of the timber industry. Economic benefit would be limited by not harvesting these trees prior to their death (Kurtz and Dwyer 1994). Normally there would be no monetary cost for the government with implementation of

Alternative 3 other than the standard custodial or stewardship costs associated with managing a National Forest. In this project, a completely new set of circumstances will have to be dealt with including: increased fire suppression costs or hazardous fuel reduction costs due to more available fuels, accident claims (both bodily and property) of private citizens as well as Government employees, road maintenance concerns and hazards, increased wildlife habitat maintenance, and additional safety issues. In the short term, no change in local jobs or income would result from the implementation of **Alternative 3**, but there would be no monetary benefit from timber harvesting to the federal treasury. In the long term, forested stands in the project would produce lower value timber, revenues to the federal treasury would continue to be lower and local employment opportunities could be reduced. The Forest Plan goal for a sustained yield would not be met and any future economic benefit would be lost.

ECONOMICS - DIRECT AND INDIRECT EFFECTS

Employment

In **Alternative 2,** timber harvested as a result of vegetative treatments would provide economic benefits beyond revenues generated by the timber sales. These benefits include local employment of harvest crews, wood products industries, and the local and surrounding businesses associated with goods and services support. In the short term, income and jobs would be produced through timber harvesting, subsequent reforestation and wildlife activities. As the indirect employment is variable, the direct employment from this project can be analyzed and expressed as crew weeks. A crew week is equivalent to three individuals producing 50 thousand board feet (MBF) of timber harvesting and three individuals producing 30 acres of non-commercial treatment in a five day week. Table E-1 below shows the expected amount of crew weeks of employment needed to complete the proposed harvests and/or felling work associated with the non-commodity alternative.

Table E-1: Crew weeks employment by alternative

	Alt 1	Alt 2	Alt 3
Crew Weeks	312*	429	0

*** Average of 15 acres a week for 3 person crew doing heavy to moderate mechanical work.**

Future Economic Values

In **Alternatives 1 and 2** the value of remaining residual trees in stands treated by intermediate harvest should increase. Regenerated stands would provide sustained yields of timber for the future, thus providing future economic benefits. Timber management activities would improve the quality and size of preferred timber species, foster the establishment of higher value, shade-intolerant tree species, and provide for a sustained yield of high quality hardwoods and softwoods. Increased long range benefits for other resources include: habitat for wildlife species requiring early successional and semi-open areas, variety in canopy closure in mature stands, healthy mast producing stands, reduced potential fire severity, decreased fire suppression costs, and a

less hazardous outdoor experience due to treatment of areas with heavy decline and mortality. While there would be costs to the government associated with the implementation of these alternatives, the costs would be offset by the revenues returned to the national treasury (under Alternative 2), job production, the resulting tax base for federal, state, and local infrastructure, and healthy, productive forest land requiring less investment over time to remain available for multiple use by all forest visitors.

Cash Flow Analysis

Table E-2 below shows a net cash flow comparison of priced activities proposed in each alternative for a relative comparison. It should not be considered actual yields or losses nor does it attempt to analyze all resource values. We recognize that many of the values generated by the various alternatives (both positive as well as negative) involve goods and services that are not priced in the market place and are thus not represented in this comparison. These goods and services involve such things as the value of a hunting experience, a hike in the woods, watching wildlife, or the quality of water flowing from the Analysis Area. The effect each alternative has on these types of non-priced goods and services is found elsewhere within this Chapter in other resource sections. The cost of producing some of these non-priced goods, i.e. creating new wildlife habitat, is included in the total cost figures. Total Cost was computed by summing up all the planning, reforestation, roadwork and other work needed to implement each alternative. Total Revenue was derived from multiplying the expected volume in each alternative with the estimated stumpage value by species. Net Cash Flow is the value left after subtracting Total Cost from Total Revenue.

	Alternative 1	Alternative 2	Alternative 3
Total Volume (MBF equivalent)	11,930**	12,050	0
Total Cost	$962,970	$1,316,500	$300,000***
Total Revenue	$0	$1,357,510	$0
Net Value	$-962,970	$41,010	$-300,000

Table E2: Cash Flow Comparisons of Alternatives *

*** From cost/revenue analysis worksheet in project file.**
**** Volume as an opportunity cost (felled, not removed)**
***** Planning Costs – Also included in Alt. 1-2**

The Net Cash Flow shows that implementation of only Alternative 2 would have a positive net return. The rank order by Net Cash Flow shows that Alternative 2 to be the most cost effective, with alternative 1 being the least cost effective. A sustained yield of timber products would support the local economies in Alternative 2.

In considering the effects on recreation activities in the project area, it is recognized that the proposed management activities may negatively affect the recreationists in his or her use of the land scheduled for treatment in the short-term. Our experience, based on feedback from field personnel and visitors themselves, demonstrates that recreationists generally move to another location if harvesting affects a primary activity. Often a suitable setting is found within a few miles of the original site. On occasion a few users may quit coming to the Forest due to the interference of proposed activities with recreational opportunities, the visitors usually returns in a few years. However, certain activities increase the use for some recreationists as well, harvesting may enhance opportunities for hunting or viewing wildlife species that require or utilize a seedling component. In the Analysis Area, the balance of these effects indicates no significant effect on recreation income or related jobs.

ECONOMICS - CUMULATIVE EFFECTS

The cumulative effects on economics from past activities, the proposed action and future foreseeable actions are at best difficult to measure but should be similar to the past ten years. One factor that has remained constant is that the local economy relies heavily on timber production, mining activities and recreation opportunities provided by the Mark Twain National Forest, as well as the associated indirect monetary benefits supporting these activities (food, fuel, equipment sales and other services).
The counties included in this project area (Bollinger, Madison, Ste. Francois and Ste. Genevieve) and surrounding counties have been involved in modern timber production for many decades. Recently, due to falling federal timber outputs, increasing harvest pressure has been placed on private lands. Stumpage rates have been stable but may see slight increases due to an improving economy (Missouri Timber Price Trends Quarterly Market Report, Vol. 13 No.2). On private lands, it is evident that the timber was liquidated, removing these lands from production for many decades. Additionally, red oak borer damage has drastically reduced the value of logs where infestations are high, and reduced the chances for sustainability over the short term until these lands can be regenerated to a more sustainable mix.

Under the no action alternative, this trend will continue. Over the long term, any of the action alternatives will help to alleviate pressure of liquidation of timber on private lands, provide market sustainability and increase value of all timberlands in the future by reducing high-risk, declining, low quality and borer damaged areas with healthy vigorous timber stands. In the short term, disturbance may displace some recreation opportunities but the sooner work to control the spread of oak decline and degradation from the red oak borer is accomplished, the sooner healthier stands and forested lands will move to a sustainable healthy condition.

SOILS - EXISTING CONDITION OF SOILS

The project areas lie within the "Southern Forests Subregion", Mark Twain Ecological Land Classification Terrestrial Subsystem (MT ELCTS). These areas lie beyond the southern limit of continental glaciation. Lands are basically stream dissected edges of a series of low plateaus. The result is a combination of ridges and valleys of varying degrees of expression. The "Ozark Province", MT ELCTS, constitutes this dissected upland. Cherty, droughty soils are a conspicuous feature of the Ozark Landscape. Within the Ozark Province is the "Salem Plateau Region", MT ELCTS, which is underlain by gently dipping lower to middle Paleozoic sedimentary

rocks, primarily limestone and dolomite. Much of this land is rough, steep, and forested with oak and pine. These projects are within the "Upper Ozark Subsection", MT ELCTS, which has soils derived from Ordovician-Cambrian-aged cherty dolomites and sandstones.

According to the Atlas of Missouri Ecoregions, the project area lies within three subsections of the Ozark Highlands Section: the St. Francois Knobs and Basin subsection, the Inner Ozark Border subsection, and the Black River Ozark Border subsection. Within the St. Francois Knobs and Basin subsection, the LTA's identified within the project area are: St.Francois Dolomite Glade/Oak Woodland Basins, St. Francois Oak-Pine Woodlands/Forest Hills, and a smaller acreage of St. Francois Igneous Glade/Oak Forest Knobs. Within the Black River Ozark Oak Border Subsection, the LTA identified within the project area is the West Bollinger Oak-PineWoodland/Forest Hills. Within the Inner Ozark Border subsection, the LTA identified within the project area is the Rocky Ridge Oak and Oak-PineWoodland/Forest Hills.

The soils of the area are typically very deep, well-drained mineral soils, which have formed in residuum and colluvium from the local sandstone and dolomite bedrock. Alluvial soils, consisting mainly of stratified silt, sand, and gravel are usually found on the valley floor floodplains. These soils are usually well-drained, although valley bottoms within the project area and areas with perched water tables can have areas of poor drainage. Many of the soils, particularly those on steeper ground, have very gravelly or stony surfaces and are skeletal (more than 35 percent rock fragments by volume) throughout the profile.

There are thirty-nine soil types, which occur on the project area for all alternatives. They are described in the tables in the appendix or can be found in the project file. Management considerations describe soil characteristics that may be affected by implementation of the proposed action or may affect implementation of the proposed action. The primary management considerations are for those soils with a fragipan and consequently perched water tables (Captina silt loam, Delassus silt loam, Hildebrecht silt loam, Killarney very cobbly silt loam, Lebanon silt loam, Scholten gravelly silt loam, Union silt loam, Wilderness gravelly silt loam, Yelton silt loam). Other soils may also have perched, seasonal, or apparent high water tables without the occurrence of a fragipan in the soil profile (Aslinger silt loam, Cornwall silt loam, Firebaugh silt loam, Fourche silt loam, Hassler silt loam, Marquand silt loam, Roselle silt loam). These other soils with high water tables occur because of their position on the landscape. . The primary example is the Clarksville/Poynor/Scholten mapping unit which occurs on nearly every stand in every compartment in the analysis area. Scholten gravelly silt loam has a fragipan in the profile and exhibits perched water tables in the winter and early spring months. Other soil types are located on stream terraces, floodplains, and some footslopes. Due to their location, these areas may experience frequent, brief flooding during the winter and early spring months. The soils on these areas are Bearthicket silt loam, Gladden loam, Higdon silt loam, Relfe gravelly sandy loam, Sandbur fine sandy loam, Secesh loam, and Tilk very gravelly coarse sandy loam. Clarksville very cherty silt loam occurs on narrow ridgetops and steep sideslopes. Due to the low available water holding capacity, shallow A horizon, and high rock content throughout the profile, the soil productivity of Clarksville and other skeletal soils on the project areas are generally low to moderate. These soils are often mapped in associations with other soils which may or may not have either a fragipan or high water tables but occurred so intricately with these other soils on the landscape that mapping each separately would have proved impractical. Nearly every stand where the proposed actions are to be implemented has a number of soil types and some of these will have high water tables. Their presence does not preclude proposed

actions if mitigation measures outlined in this environmental assessment and in the Forest Plan are employed. The soils tables in the appendix give their location and are given for all stands for all compartments in the analysis area. This was done to give a landscape picture of where these soils occur.
Ecological land types (ELT) were analyzed as well. The dominant ELT's were 17 and 18, which denote south/west north/east facing slopes respectively and occur on slopes ranging from 8 – 34 percent on the project areas. Other ELT's which also occur on the project areas are: ELT 2 (low terrace flood plains, neutral aspect, 0 – 4 percent slopes), 5 & 6 (upland waterways, neutral aspect, 0 – 4 percent slopes), 7 (toe slopes, all aspects, 0 – 14 percent slopes), 10 and 11 (ridge tops, neutral aspect, 0 – 8 percent slopes), and 13, 14, &15 (flats, neutral aspect, 0 – 8 percent slopes), 24 (south and west side slopes), 25 (north and east side slopes), 26 & 27(side slopes, all aspects on igneous glades or xeric igneous forest), and 28 (flats, neutral aspects, 0 – 8 percent slope). The other management consideration is soils on steeper slopes. These soils are susceptible to erosion (especially on south facing aspects). When disturbed by harvesting activity, soils in these slope and aspect conditions can be subject to erosion levels in excess of standards of the Forest Plan. Most of the stands for all alternatives are on slopes between 15 – 35 percent. Erosion hazard for each of the soils are in the alternative treatment table in Appendix B.

Desired Future Condition for Soils

The purpose of this project is to change existing conditions to conditions that more closely resemble the desired future condition by maintaining healthy and functioning oak/hickory/pine forest communities in all their successional stages. In the past, fire maintained some of these ecosystems. Prior to European settlement, a mantle of loess of two to five feet blanketed southern Missouri, which was extremely productive and provided the substrate for a rich and diverse floral community above ground and an even richer and more diverse floral and faunal community below ground. (Scrivner 1966) Past land use has resulted in the erosion of most of this mantle.

The desired future condition includes restoration of soil productivity potential. It is unrealistic and impossible however to duplicate geologic processes and restore the soil to pre-settlement conditions in the foreseeable future. Soil formation is a long, time consuming process which could take hundreds to several thousand years to return to that previous condition. (Buol, Hole, McCracken, Southard 1997) However, the present project, future projects, other similar project proposals on the Forest, and the mitigation measures employed can be expected to reduce soil erosion in the short term and continue the soil formation process in the long term so soil restoration can proceed in the direction towards that desired future condition.

SOILS - DIRECT AND INDIRECT EFFECTS

The stands that are proposed for treatment in this project cover a wide range of landscapes throughout the Fredericktown Ranger District.

Many of the treatments in Alternatives 1 & 2 involve felling of trees at different intensities. Thinning and tree harvest would leave remaining trees to occupy sites and maintain water budgets and nutrient cycles at current levels.

General Effects of Soil Erosion

Because soil is eroded off the surface horizon, erosion results in a loss of nutrients for forest productivity. (Fisher et al. 2000) It also results in a loss of biodiversity of thousands of species of soil micro-organisms numbering in the millions of total organisms which are lost to the

site where the erosion was taking place. (Pierzynski, Sims, Vance 2000) In addition, erosion also results in a loss of carbon which was sequestered in the surface horizon. (Boyle, 2002)

Erosion Hazard is rated according to risk of erosion on forestland where normal practices are used in managing and harvesting trees. A rating of **slight** indicates soil loss is not important concern; a **moderate** rating indicates that some attention to soil loss is required; and a **severe** rating indicates that intensive treatments (such as seeding and mulching disturbed areas, water bars, etc.) or special equipment and method of operation are required to minimize erosion. Potential erosion hazard is based mainly on slope and erodability as well as on soil depth. Soils in the ELT's Numbers 17, 18, 24 - 27 are most susceptible to erosion.

There are various prediction models for soil erosion and more specifically rill and sheet erosion. The WEPP model has recently been used to predict erosion levels from harvesting activities. Use of the specifications in this EIS would reduce all these erosion levels significantly and within Forest guidelines.

Equipment Limitations are rated according to the degree to which soil characteristics restrict or prohibit tree-harvesting equipment. A rating of **slight** indicates little or no restriction on the type of equipment that can be used; a **moderate** rating indicates the use of equipment is seasonally - limited, or that modified equipment (rubber tired skidders rather than crawler-type tractors) are needed; and **severe** rating indicates that special equipment is needed or that use of such equipment is severely restricted by unfavorable soil characteristics. Steep slopes indicate a safety hazard for equipment.

Potential of Damage to Soil From Fire is rated according to the degree to which soil characteristics are reduced in productive capacity from fire. The ratings (low, moderate, high) are made on the basis of texture, amount of coarse fragments, slope, and surface soil. Most of the soils associated with this proposal have a rating of low to moderate potential.

Suitability for Pond Development is rated according to the degree soil characteristics affect or have limitations for the pond reservoir areas. The limitations are considered slight if soil properties and site features are generally favorable for this use and limitations are minor or easily overcome. Limitations are considered moderate if soil properties or site features are not favorable for the this use and special planning or design, or maintenance is needed to overcome or minimize the limitations. Limitations are considered severe if soil properties or site features are so unfavorable that special design, significant increase in construction costs, and possibly increased maintenance are required. Soils best suited to this have low seepage potential in the top 60 inches. The seepage potential is determined by permeability in the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect storage capacity of the reservoir areas.

Soil surface disturbance is one of the effects of the activities proposed. Management activities associated with timber harvest, regeneration, and TSI in Alternatives 1 & 2 would cause some soil disturbance. Potential exists for soil compaction, soil puddling, soil displacement and soil surface erosion, as a result of heavy equipment operation on sites where management activities would occur in Alternative 2. There would be little loss of landform from road reconstruction as these areas have already been disturbed. Soil surface disturbance is important because it has an impact on soil quality, maintenance, and sustainability. This disturbance would be expected to occur on or adjacent to skid trails and landings both during and after the activities take place. The Standards and Guides of the Forest Plan are designed to minimize the

amount of disturbance from management activities. Assessment of proposed activities on specific sites would determine if the degree and extent of soil disturbance would cause appreciable change in soil properties to be considered detrimental to the long-term productivity of the land. Determination of effects is based on available research, the recently completed soil surveys for Madison, St.Francois, St. Genevieve, & Bollinger Counties, and professional judgment. Adherence to Forest Plan (FP) Standards and Guidelines (S&G) and site-specific mitigation measures that follow would result in no appreciable changes in the inherent long-term productivity of the land.

Soil limitations for the stands in the proposed alternatives range from slight to severe. Slope percentage and depth to water table are dominant factors, which impose limitations. Erosion hazards are slight to moderate in most stands although the hazard can be rated as severe when slope percentages increase. The potential of damage to soil from fire ranges from slight to moderate for most soils in most stands though the hazard can become severe on steep slopes.

Alternatives were evaluated to assess whether implementation of the proposed project would result in any detrimental or beneficial effects to the soil resource. Harvesting, prescribed burning, timber stand improvement, and wildlife projects can affect soil productivity and soil quality. Alternatives can be compared based on the relative effects of soil disturbance.

The Forest Service Internet-based interface to the Water Erosion Prediction Model (FSWEPP; Elloit et al 2000) was used as part of this analysis. Climate was simulated for ten years at the Salem, Missouri to obtain a range of wet and dry conditions. Erosion and sedimentation predictions must be evaluated with a full understanding of the uncertainties.

"At best, any predicted runoff or erosion value, by any model, will be within only plus or minus 50 percent of the true value. Erosion rates are highly variable, and most models can only predict a single value. Replicated research has shown that observed values vary widely for identical plots, or the same plot from year to year (Elliot et al 1994; Elliot et al 1995; Tysdale et al 1999) Also, spatial variability and variability of soil properties add to the complexity of erosion prediction. " (Robichaud 1996) (Elliot et al 2000) (excerpted from Disturbed WEPP (Draft 02/2000) WEPP Interface for Disturbed Forest and Range Runoff, Erosion and Sediment Delivery (William J. Elliot, David E. Hall, Dayna L. Scheele. U.S.D.A. Forest Service Rocky Mountain Research Station and San Dimas Technology and Development Center, February 2000) online from http://forest.moscowfsl.wsu.edu/fswepp/docs/distweppdoc.html

FSWEPP provides relative versus absolute results to estimate and compare the magnitude of effects of alternatives. The analysis allows a comparison of alternatives but does not predict the effects for a specific stand.

Alternative 1 – Forest Health/Non commercial harvest

Mechanical Methods

This alternative allows stands to be treated mechanically to achieve stand conditions that would favor regeneration and renewal without commercial harvest. 850 acres of heavy mechanical methods would resemble seed tree and final harvest cuts. Impacts to the soil resource would be reduced in this alternative as logging roads and skid roads and trails would not be reconstructed for access and harvesting equipment would not be employed. Compaction and erosion which would be expected to accompany a harvesting operation would not be experienced.

Some erosion would be expected to occur due to decreased canopy closure and ground cover. The amount of bare ground after a seed tree operation can be expected to be somewhat less than for a clearcut although erosion from precipitation can take place until ground re-vegetation takes place one to five years after harvesting. Biomass felled and left on the forest floor would also aid in reducing erosion and sedimentation in adjacent streams. Depending on the slope, weather and soil characteristics, erosion levels initially could exceed Forest Plan Standards and decrease to pre-treatment levels within a few years.

3, 904 acres of moderate felling would resemble shelterwood and thinning harvests. Canopy closure would be higher immediately after treatment than for seed tree felling. Depending on the slope, weather and soil characteristics, erosion levels initially could still exceed Forest Plan Standards and decrease to pre-treatment levels within a few years.

Positive impacts to the soil resource could be expected due to the trees remaining on site. Over time breakdown of foliage and small branches would result in increased nutrient levels. Soil macro and micro-organism biodiversity would increase in number and functional groups. Nutrient cycling in those stands selected for prescribed burning would be covered in the next section.

Prescribed Fire

The effects of prescribed burning on soil erosion and nutrient capital are related to the slope, soil characteristics, and the severity of the burn. These effects are complex and depend on a host of factors but certain generalizations seem relatively consistent. Burning has its most pronounced effect on the forest floor where carbon (C), nitrogen (N), and sulfur (S) are volatilized and calcium (Ca), magnesium (Mg), potassium (K), and phosphorus (P), and other elements are left as ash. The ash is leached by rains into the mineral soil which increases its base saturation and pH. (Alban 1977) Increased nutrient availability at higher pH's may result in positive plant responses following fire. (Van Lear and Kapeluck (1989) These generalizations coincide with results from a variety of other reviews and studies. (DeBano 1998) (Luckow, 2000a, 2000b, 2000c) (Godsey 1988) (Amelon 1991) (Schlesinger 1997) Erosion can increase as a result of prescribed fire, but WEPP model runs indicate that the erosion levels are generally within soil tolerance guidelines (set up by the NRCS and the ARS) and are much lower than erosion and sedimentation levels after a high severity stand replacement fire. Even if a wildfire occurred in areas treated with prescribed burning, these areas would experience less erosion damage after the fire, wildfires would not burn as hot, and trees may be left with a portion of their foliage. (Hayman Fire Case Study Analysis, cited within E-Forester published by SAF, February 24, 2003)

Erosion from skid trails, landings, and forest roads on ridge tops is similar to erosion from a fire line. The FSWEPP model was run using skid trails on a various slopes and soils. A fuller analysis for various scenarios is given in the Appendix. Silt loams (both skeletal and non-skeletal) and a variety of slopes were modeled. The highest probability of erosion and sedimentation would occur after a prescribed fire on steeper slopes within 100 feet from a stream

Old Growth Designation

No ground disturbing activity is expected from old growth management and designation. Natural functions and processes is expected to occur.

Riparian and Special Area Protection

Relocation of the Audubon Trail out of the floodplain of Bidwell Creek would decrease the probability of sedimentation into the Creek

while still allowing use of the trail. Rehabilitation of Artesian well and surrounding areas are measures designed to improve and enhance watershed health. Reduction of sediment delivery into Castor River at Marquand via road maintenance and seasonal closures would further improve and enhance watershed health.

Alternative 2 – Modified Proposed Action

Silvicultural Methods

Seed tree felling and harvest are similar to heavy felling of the non-commercial treatments of Alternative 1. Soil disturbance would be increased in this alternative as trees are being removed from the site. Harvesting equipment, skid trails, and logging road reconstruction would be required to accomplish this. Additional erosion and sedimentation would result especially on steeper slopes and during periods of heavy precipitation and can be expected to far exceed Forest Plan standards initially and return to near pre-treatment levels within five years as re-growth of vegetation takes place.

Shelterwood, uneven-aged management, sanitation/thinning, and overstory removal are similar to the moderate felling treatments of Alternative 1. Soil disturbance would be increased in this alternative as trees are being removed from the site. Harvesting equipment, skid trails, and logging road reconstruction would be required to accomplish this. Additional erosion and sedimentation would result especially on steeper slopes and during periods of heavy precipitation although the levels would be less than that for the seed tree harvesting.

Reforestation and TSI Activities –

Reforestation via natural regeneration is not a ground disturbing activity and would proceed as a natural function and process. Timber stand improvement via crop tree release and pine release would not leave bare ground open to erosion and runoff. Biomass felled and left on the ground would further reduce whatever minimal erosion may occur during heavy precipitation periods. Crop tree release and pine release would allow remaining trees to occupy sites and maintain water budgets and nutrient cycles at current levels. Positive impacts to the soil resource could be expected due to the trees remaining on site. Over time breakdown of foliage and small branches would result in increased nutrient levels. Soil macro and micro-organism biodiversity would increase in number and functional groups.

Prescribed Fire Activities

Impacts to the watershed resources (positive and otherwise) would be identical to Alternative 1.

Transportation Activities

This part of the alternative involves 37 miles of road reconstruction and maintenance. The impacts of road construction and maintenance encompass the following issues that are addressed below:

-Surface and subsurface hydrology

Road surfaces and drainage ditches modify the surface hydrology of the project areas by intercepting ground and surface water and routing it more quickly to stream channels through the ditch system. Many of the roads in the project area, particularly non-National Forest System public roads and private roads have been in place for a long time, in cases up to a hundred plus years. Most of these roads are gravel, coarse rock or dirt surfaced and have been graded or regarded for decades, with little or no intent of maintaining the road crown, ditches, or cross drainages, becoming entrenched in the process, sometimes to depths of several feet. Entrenched roads of this type

are located on ridge-top, hill slopes and valley bottom landscape positions throughout the analysis area. Valley bottoms, which contain coarse alluvium, serve as recharge areas for the surface and ground water systems. Ridge-top and mid-slope roads can reduce or alter overland flow processes by intercepting the water in a ditch system and routing it quickly to surface water, or by compacting areas that previously had been permeable. In addition, there a number of existing un-inventoried roads and trails not on project maps, which intercept surface flows. In order to progress toward proper flow paths, mitigate erosion potential and accommodate resource use, periodic maintenance of running surfaces and ditches or reconstruction of these facilities is critical.

-Sediment and Erosion

The primary source of sediment and erosion in wildland environments is the road systems. The road and highway system in the project areas can contribute significant amounts of sediment and pollutants primarily through road surface. The surface of these roads prevents infiltration and increase runoff during periods of precipitation. Road stream crossing can also generate surface horizon. Each watershed in the project contains numerous stream crossings that are gravel or natural surface. Roads within 100 feet of streams add several miles of channel extension. Additional miles of "other" roads of unknown origin condition are located in the watersheds within the project areas. Each of the above has the potential of increased surface erosion and sedimentation into nearby streams.

Non-system roads and other roads of unknown condition (Federal and non-Federal) have been used as webs of off-road vehicle use. This can result and has resulted in significant amounts of erosion in the past and will likely continue in the future. The primary opportunity for reducing this impact appears to be partnerships with ORV groups in rehabilitating and restoring these areas. The Forest is also beginning an ATV trail study that will seek to provide the answers to the extent that ATV trails impact aquatic and riparian resources. One of the primary study sites on the Forest is in the Cherokee Pass area, located within the project area. Another outcome of this study may be to decrease illegal off road and trail use by expanding official ATV and ORV trail area available in areas with lower risk of adverse impacts.

Water bars and other erosion control measures on system roads and skid roads are often the outlets where water on roads is directed onto the hillside. There is a great diversity in the quality of these erosion control practices not only on the project areas but also throughout the Forest due, in part, to the contract administration on project work. Many erosion control measures in certain areas are quite effective at reducing erosion while the same measures in other areas appear to create more soil disturbance than they prevent. Well-constructed and maintained erosion control measures are a tool to keep surface erosion at minimal levels.

A sensitivity analysis using the WEPP Road model revealed that a well maintained out-sloped, non-rutted road results in lower erosion and sediment levels all other factors being equal. Erosion levels of an out-sloped, un-rutted road compared with a bare ditch, rutted, in-sloped road resulted in half to one-third reduction the erosion and a third to a fourth of the previous sediment levels leaving the road buffer. Timely road maintenance remains one of the most effective tools for keeping road related erosion and sediment to minimal levels.

Road grade can have a significant on erosion and sediment levels. Increasing road grade from 4 to 8 percent could result in a 25 – 33 percent increase in erosion and sediment leaving the buffer. Road surface can also have an effect on erosion and sediment. Roads in the project area range from natural surface to gravel to paved. Erosion and sediment levels would range also.

Reconstruction and maintenance would be expected to reduce this erosion/sediment levels to a fraction of pre-treatment levels.

-Road stream crossings

Classified forest roads in the project area avoid, to the extent possible, crossing perennial streams. There are a number of low-water crossings, mainly on ephemeral, intermittent and interrupted stream channels in the analysis area. Seasonal or storm-water flows occur periodically at road-stream crossings. These are sites where sediment generated by road surface and roadside erosion and other road related pollution could directly enter the aquatic systems. Use of these crossing during water flow will cause small gravel and fine sediments to be displaced and moved downstream. Non-classified roads intersect or run adjacent to intermittent stream channels in several locations within the project area. Those that run within 100 feet of stream channels have the highest probability of producing sediment which would enter the stream. GIS analysis indicates that many of these areas occur in the East Fredericktown area.

-Pollutant entry into surface waters

Road crossings provide the greatest potential for pollutants to enter stream systems. Valley bottom roads also represent a potential route for contaminants to enter surface waters. The potential for pollutants to enter surface waters would most likely occur during actions on the road systems not associated with Alternative 2 of the proposal. Alternative 1 and 3 would not affect the entry of pollutants into surface waters due to the non-commercial and no action (respectively) aspects of these alternatives.

-Hydrologic connection

The road system is directly connected to the stream system at low-water crossings, where the streambed serves also as the roadbed. Mid-slope and valley bottom roads drain surface runoff and groundwater more efficiently which increases peak flows. In general, the lower a road is in the watershed, the greater the impact.

In and adjacent to the project areas, GIS analysis shows the road and stream systems directly connected in numerous areas. They're also numerous areas where streams and roads are within 100 feet of the other. This adds several miles of channel extension and, depending on many factors, adds several miles of potential sedimentation sources.

-Beneficial Uses

Designated beneficial uses within the analysis area watersheds include: fish and aquatic life, recreation, water supply, and agriculture. The analysis area includes municipal water supplies in communities such as Fredericktown and Marquand. These and other communities are supplied by ground water derived from the underlying St. Francois and Ozark aquifers. Fish and aquatic life are the water uses most affected by road-derived pollutants. Sediment can decrease habitat quality and spawning success for fish species and alter habitat for aquatic invertebrates. Chemical and other road-derived pollutants can kill or stress fish species and other aquatic life.

-Wetlands

Valley road bottoms cross-wetlands in very few locations, typically at or near stream crossings. Very small and localized areas of wetlands occur as side-hill seeps in the vicinity of springs throughout the valleys of the Salem Plateau. Most of these wetlands are relatively small (less than one acre) in size and not mapped. Side-slope roads often intercept these seeps and re-route their flows into roadside ditches or under the road by culvert or small bridge.

There are thirty-nine soil types, which occur on the project area for all alternatives. The primary management considerations are for those soils with a fragipan and consequently perched water tables. Other soils may also have perched, seasonal, or apparent high water tables without the occurrence of a fragipan in the soil profile. These other soils with high water tables occur because of their position on the landscape and may occur in mapping units with other soils that do not exhibit high or perched water tables. Other soil types are located on stream terraces, floodplains, and some footslopes. Due to their location, these areas may experience frequent, brief flooding during the winter and early spring months.

-Physical channel dynamics (isolation of floodplains, channel migration, movement of wood, fine organic matter and sediment).

Physical channel dynamics have not been altered in recent history by the road systems. Changes to stream channels occurred from the historical land use that established original roads and stream crossings. It is desirable from a transportation management standpoint to control channel dynamics at road crossings to provide year-round access. This necessitates the isolation of streams from floodplains at some of the road crossings. Flooding is most evident at stream crossings as stream flows exceeds crossing capacity or crossings become blocked with flood debris and cannot handle high flows.

Current constraints on channel migration are maintained to protect roads at streams crossings and adjacent to roads in riparian areas. Most riparian areas and floodplains in the project areas are narrow and the main stem streams are bedrock controlled. These features help create a low frequency of natural channel migration in main stem streams. Floodwaters will utilize floodplains on main streams and will flow down roads if in proximity to streams (especially if within 100 feet of streams). When riparian roads act as overflow channels the stream energy can be modified so that materials are deposited on road surfaces and from road surfaces to stream channels. Headwater streams are usually most sensitive to disturbance by road systems, road maintenance, and road construction.

Movement of materials downstream is enhanced where runoff is delivered to the stream channels. Incorporation of boulders and large woody debris as habitat components may be limited in main channels if movement of these materials is accelerated by larger flow volumes and little resistance from the bedrock substrate. Another factor affecting the incorporation of boulders and large woody debris as habitat components is the lack of these components in stream channels, whether by removal or lack of recruitment potential . If large materials are trapped at crossings are removed as part of road maintenance activities. Scarcity of these materials can negatively affect fish habitat quality. The factors may be present for this process to occur.

Old Growth Designation

No ground disturbing activity is expected from old growth management and designation. Natural functions and processes are expected to occur.

Riparian and Special Area Protection

Impacts to watershed resources (positive and otherwise) would be identical to Alternative 1.

Alternative 3: No Action Alternative

No new management activities would take place, nor any associated activities with the proposed action. Therefore, no management related appreciable changes in productivity of the land would occur. Soils would be impacted by regular maintenance and use of roads as well as planned and ongoing natural resource management activities. In the absence of wildfire, current runoff and erosion pattern

would be maintained. An upland erosion rate of less than one ton per acre per year is predicted by FSWEPP for stands on steep slopes in the absence of fire. Natural processes and functions would continue to occur as dead material decomposes. Actual soil organic matter may increase with an accompanying increase in microorganisms and fungi. Since there is no harvest, no carbon would be removed from the forest. Dead and dying trees would decay with carbon released to the atmosphere. Management activities in and adjacent to the project areas already planned would be carried out.

Under this alternative, fuels will not be reduced nor will biomass be removed through silvicultural treatments including but not limited to prescribed burning. Fire suppression has resulted in increased fuel loading and possible loss of savanna and glade environments present during presettlement times. (Heikens 1999) Wildfires that could occur under conditions of increased fuel loading can be expected to burn at a higher intensity and over a larger area than would have occurred if fires had burned at historical fire frequencies. The probability of stand replacement wildfires could be expected to increase in the absence of fuel reduction through silvicultural treatments in this proposal. The stands in other alternatives where wildfire does not occur would maintain current runoff and erosion pattern. An upland erosion rate of less than one T/A/Y is expected for stands on steeper slopes and near water if fire is excluded. Fire exclusion would result in accumulation of hazardous amounts of fuels.

Lack of fuel reduction could result in stand replacement wildfires and increase the probability and levels of erosion and sedimentation from lands where these fires occur. FSWEPP modeling indicates that a high severity fire for conditions similar to those described above would produce a ten to twenty fold increase in erosion (depending on slope) and a like increase in sedimentation. Predicted erosion and sediment quantities are listed in the Appendix . According to the model, wildfires produce ten to twenty times more erosion than do prescribed burns.

Wildfire control would more likely involve bulldozer constructed firelines. Overland flow in firelines would further erode soils and be a source of sediment. A twelve foot fireline constructed by dozer along a 5,700 foot perimeter of the average 25 acre stand in East Fredericktown project area (the area affected by the wildfire may well be far above 25 acres) would total approximately 1.6 acres (about 6.4 percent of a 25 acres steep stand could become an erosive fireline in the event of a wildfire). If the dozer lines are constructed on soils with fragipans, especially during periods of wet weather, the erosive potential would be increased and some of the soil structure would be destroyed. Predicted erosion rates for various scenarios are given in the Appendix.

SOILS - CUMULATIVE EFFECTS

Most of the soils in the assessment developed in loess – a loamy material formed by glaciers and transported by wind – and in residuum from cherty limestone, dolomite, and sandstone. The soils are old, stony, highly weathered and acidic, except on some broad ridges and bottomlands. (USDA Forest Service, MTNF 2001)

Loess is a loamy, wind deposited material, most of which was deposited during glacial periods. In the assessment area, the mantle of loess varied in thickness from five feet to less than two feet, the loess deposits decreasing in depth in the southern most areas of the Ozarks. Soil conditions were described as ranging from “barrens and prairies …, the soils poor and covered with grass, …” to “the soil rich with a heavy growth of trees.” (Nigh 1992)

(Schoolcraft 1821) In many areas in this area, up to 90 percent of this mantle has been eroded away. (Scrivner, 1966) Aside from erosion occurring from geologic and other natural processes, erosion is a function of past land use. Clearcutting of pines, which began near the turn of the century and continued through the 20's and '30's, was followed by farming, annual burning and grazing. When the timber supplies were exhausted, local people turned to farming. Those attempting to pasture the cutover lands had to contend with resprouting of hardwoods . Intensive sheep and goat grazing and fire were the primary means of controlling hardwood regrowth and restoring grass cover. Repeat fires exposed the thin Ozark soils to erosion, which robbed the hillsides of the nutrients essential for both grass and tree growth. (Cunningham and Hauser 1992) With the loss of ground or canopy cover, erosion of the loess mantle continued. (Hammer, personal communication) (Jacobson and Primm 1994) During this period of settlement, it was estimated that six to eight inches of surface soil had been washed away. (Law 1992) (USDA Forest Service 1952) From the end of the 1930's to the end of the 1950's, public land managers became concerned with healing the eroding lands, ending annual woods burning, and establishing young forests. Even so, it was 1969 before the period of free roaming livestock ended. (Law 1992) (Keefe 1987) As a result, many of the soils in the assessment area have shallow surface horizons, low available water holding capacities, and relatively low soil fertility
On Forest Service lands, past activities include timber harvesting and associated road building, landings, haul roads, mining and wildlife openings construction and maintenance. The past activities of timber harvesting and wildlife openings on National Forest system lands have had no long-term negative impact on the soil productivity with the mitigation measures applied. There is no evidence of accelerated erosion in the uplands. Areas where there have been timber harvests in the past have re-vegetated and there is no bare soil exposed in the closed cutting units. Some of the roads in the Project Area will be reconstructed. There are a number of unclassified non-system roads that are present in some of the areas that could be used for temporary haul roads. This will reduce the amount of new roads needed and will reduce the amount of associated sediment movement. No appreciable long-term soil disturbance effects have been identified, primarily because of methods used and mitigation measures applied.

Recent activities within the Fredericktown Ranger District area include the timber sales associated with Project Tornado, which is still in place. The timing of this project resulted in harvest activities during the winter months and moist soil conditions. Soils in these areas were frequently in soil map units with soils that had perched water tables during the winter months due to presence of a fragipan in the soil profile. The potential for erosion, compaction, and destruction of soil structure remains high in these climatic conditions. Strict contract administration was instrumental in limiting or avoiding these detrimental impacts.

Future activities within the Fredericktown Ranger District (other than the proposed action) include the Clear Creek proposal. This project is located over four management units and stands in 35 compartments and over 7,000 acres. Activities in this proposal are regeneration harvesting, reforestation, timber stand improvement, hazardous fuel reduction and wildlife projects. Like the timber sales associated with Project Tornado, many of the soils in these areas exhibit perched water tables during winter months due to the presence of fragipans in the soil profile and are subject to erosion, compaction, and destruction of soil structure. Adherence to the Forest Plan Standards and Guides, mitigation measures in the E.I.S., and strict contract administration will be critical in minimizing detrimental impacts to the watershed resources.

On private lands past activities have included conversion of forested land to pastures, timber harvest, and road building. During the conversion process to pastures there was an increase in the sedimentation of streams and creeks and their tributaries. For a fuller description of this, refer to the watershed and water resource sections of this document. As common in the Ozark region, most of the riparian areas consist of private lands and surrounding uplands of perennial streams of the project area. In areas where the landowners left an adequate woody corridor along the perennial streams, the stream banks along the creek appear fairly stable. Other areas without an adequate woody corridor along the streams exhibit signs of accelerated bank erosion. The majority of the land clearing has been the conversion from hardwoods to cool-season grasses. Removing the hardwoods in the uplands and along the stream channel had a major impact on the stability of the channel. It is not known how much additional land will be cleared and what the associated sedimentation of the stream will be as a result of activities on private lands, though it should be similar to the past.

The management activities proposed under this environmental analysis will result in some soil disturbance. This disturbance will be a result of temporary roads, fireline construction, logging, and prescribed burning. The temporary roads (for all types of harvest methods) and firelines that are on the steeper slopes and/or cross the intermittent or ephemeral drainages will be the primary source of sediment in the unlikely event that sedimentation may occur. The sediment increase will be highest during construction and eventually will be reduced as the roads become stable and vegetated. This may take up one full growing season, but can be shorter if the re-vegetation and growing season are compatible. Closing and obliteration of the temporary roads is critical in bringing the erosion rate down to pre-harvest and pre-construction levels. Timber harvesting will have minimal impact on the sedimentation of the streams or drainages. Using the mitigation measures listed in this assessment and Forest Plan Standards and Guides, there will be adequate filter or buffer strips to help filter any sediment through the forest floor before reaching drainages.

In the stands that will have regeneration harvest, seldom is more than 5% bare soil exposed within the cutting units if proper care is taken during the harvesting and timber stand improvement process. The hardwood slash acts as a protective cover for the soils and can help mitigate compaction if used during harvesting. The stands that will have prescribed fire will have potential for soil erosion. This erosion will result from the construction of firelines and possibly from the burn unit. The increase in erosion from the burn unit is a direct result from fire intensity. Burning with a cooler fire the soil erosion is usually minimal, due to the protective duff layer that is still present. If there is an increase in soil erosion it is usually of very short duration. On the stands that will have various selection harvests (seed tree, shelterwood, thinning, sanitation cuts, uneven-aged management, overstory removal, etc.), some minor soil erosion is expected to occur. In these stands there will be enough ground cover or slash to protect any bare mineral soil. Mitigation measures listed in the Chapter 2 are effective in minimizing adverse impacts to the soils. Similar management activities will potentially be proposed in the reasonably foreseeable future and would be accompanied by the appropriate mitigation measures.

WATER QUALITY - EXISTING CONDITION OF WATER QUALITY

The Project Area lies within two major 8-digit hydrologic units: Headwater Diversion and Mississippi Lower. Water south of “T”

Highway flows into the Headwater Diversion watershed and for the most part water north of "T" Highway flow into the Mississippi Lower Watershed.

In the Headwater Diversion watershed, the headwaters of the Castor River and a small part of the headwaters of Whitewater River are the two major drainages in the project area.

In the Mississippi Lower Watershed, the headwater of Saline Creek is the major drainage in the project area.

Classification and Designated Uses

The Castor River from T34N,R8E,S19 to T34N,R8E,S7 (total of 2 miles) is classified as intermittent, gaining and designated for: livestock and wildlife watering, and protection of warm water aquatic life and human health-fish consumption. The Castor River from T29N,R9E,S29 to T34N,R8E,S19 (total of 59 miles) is classified as perennial, gaining and designated for: livestock and wildlife watering, protection of warm water aquatic life and human health-fish consumption, cool water fishery, whole body contact recreation, and boating and canoeing. The Whitewater River from T34N,R9E,S29 to T34N,R8E,S10 (total of 6.5 miles) is classified as intermittent and designated for livestock and wildlife watering, and protection of warm water aquatic life and human health-fish consumption.

Saline Creek from T35N,R8E,S16 to T35N,R7E,S11 (total 3 miles) is classified as intermittent, gaining and designated for livestock and wildlife watering, and protection of warm water aquatic life and human health-fish consumption. Saline Creek from T36N,R9E,S13 to T35N,R8E,S16 is classed as perennial, gaining and designated for livestock and wildlife watering, protection of warm water aquatic life and human health-fish consumption, cool water fishery, and whole body contact recreation.

Surface Water Quality Monitoring

The Missouri Department of Natural Resources (MDNR) maintains a water sampling site (0119521) on the Castor River located in the SW1/4, Section 10, T33N, R8E, Madison County and a water sampling site (0010169) on Saline Creek in NW1/4, Section 31, T36N, R9E, Ste. Genevieve County. Biological and chemical samples have been taken at each site. The Castor River and Saline Creek are considered reference streams for the Ecological Drainage Units (EDU) established by MDNR. An EDU is a region in which similar biological communities are expected to be found. Results of the biological assessment are summarized by the Macroinvertebrate Stream Condition Index (MSCI), which ranges from 4 (very poor) to 20 (very good). From 1999-2001, five samples were taken from the Castor River site 0119521. Four of the samples scored 20 (very good) and one sample scored 16 (good). From 1999-2000, four samples were taken from Saline Creek site 0010169. The scores for these four samples were 14 (fair to good), 18 (good), 20 (very good), and 18 (good). Results of the chemical assessment are determined by water grab samples taken at the time of biological sampling. Water quality parameter values such as water temperature, dissolved oxygen, phosphorus, ammonia, discharge, turbidity, conductivity, chloride and nitrogen were measured at both sites. Both sample site streams meet established criteria as defined in Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality for those beneficial uses. Surface water quality in the Castor River is excellent and surface water quality in Saline Creek is good. A summary of the MDNR biological and chemical samples taken at each site can be found in the Project Files.

According to Priscilla Stotts, Stream Team Coordinator, Castor River Stream Team Site 6321.01 at SE NW NW S10 T33N R8E data indicates that the Macroinvertebrate Water

Quality Rating to be Good (18, 22) and Excellent (24, 29). Castor River Stream Team Site 5209.01 SW S10 T33N R8E data indicates that the Macroinvertebrate Water Quality Rating to be Good (23). Chemical Data from both sites fall within the MO Clean Water rules 10 CSR 20-7.031 Water Quality Standards Numeric Criteria for Classified Streams and the Federal Clean Water Act. Dissolved Oxygen was reported above the 5 mg/L minimum, pH readings are within the 6.5 to 9.0 units, Water Temperature was below the 32.2 C maximum, and Ammonia reading are well below the toxicity levels. A summary of the stream team biological and chemical samples taken at each site can be found in the Project Files.

303(d) list

Section 303(d) of the Federal Clean Water Law requires that states identify those waters for which current pollution control measures are inadequate. This is accomplished by comparing data from those waters with water quality criteria established for designated beneficial uses of those waters. Waters that do not meet their criteria are then included in the 303(d) list (MDNR 2003). The state must then conduct Total Maximum Daily Load (TMDL) studies on those waters in order to determine what pollution control measures are required and then insure those measures are implemented (MDNR 2003). Currently, there are no streams within the Project area included in the 1998 303(d) list.

Ground Water (Artesian Well)

An artesian well is located on National Forest land at the intersection of Bollinger County Road 872 and Forest Road 2137 in the NW ¼, NE ¼, NW ¼, NW ¼, Section 11, T32N, R8E. It is in an area that has known springs. There is an old housesite located across the county road from it. Some foundations are still present but overgrown with honeysuckle. The Forest Service purchased the land from A.J. Hollerbach in 1967.

John Paul Skaggs, who is a local historian, stated Buster Matthews drilled the well. Mr. Matthews stated he was in charge of drilling the hole for National Lead Company in approximately 1952 or 53 as a prospecting hole for lead. He stated the well is cased down to 400-500 feet and cored drilled down to 900 feet. When asked who capped it, Mr. Matthews stated the locals did in the 60's (Ted Leimer, per. Com.).

The well seemed to be the best source of drinking water in the area. The casing is surrounded with a 55-gallon drum filled with concrete. On top of this, an old brake drum is bolted with a 2" pipe welded to it. The local people slip a 2" black plastic pipe over this with the other end in their portable water tank (Ted Leimer, per. Com.).

The brake drum is rusting out and leaking, which has lowered the height that the water reaches when it exits the pipe. At this time it only extends about 4-5 feet above the pipe (Ted Leimer, per. Com.).

The well does not meet the definition of a public water supply according to Gary L. Gaines (per. Com., July 2003), of the Southeast Regional Office, MDNR. This artesian well is not listed in the U.S. Geological Survey data base (per. Com., Jeffrey Imes, June 2003).

Potential Non Point Source Pollution

Whereas point source pollution can usually be traced to a single discharge point; non point source pollution, such as sheet erosion of topsoil, runoff of nutrients from pastures, pesticide or fertilizer runoff from fields, is much more difficult to detect as well as remedy.

Currently, the Fredericktown unit is a popular area for off road vehicles (ORV). There are approximately 40+ miles of non-system roads

within the Project area. ORV use of roads along and near ephemeral and intermittent stream courses can negatively impact water quality. Repeated stream crossing and in-stream operation by ORV's will cause physical disruption of stream substrates. It is possible the stream bottom could destabilize, resulting in the suspension and transport of organic material downstream.

There are 11 active dumpsites on NF lands located adjacent to County and Forest Service roads within the project area. These dumps sites consist mainly of household trash and rubber tires. There are no known chemical hazards associated with these dump sites. None of these dump sites are located in perennial stream courses.

There is rutting and exposed soils around the Artesian well site located at the intersection of Bollinger County Road 872 and Forest Road 2137.

WATER QUALITY - DIRECT AND INDIRECT EFFECTS

Alternative 1:

In this alternative, forest health would be accomplished without the use of commercial harvests; thereby, eliminating the need for skid trails and temporary haul roads. This action would reduce the amount of sediment moving off site. Non-Point source contaminants of silvicultural activities as proposed in this alternative are not significant enough to have an adverse effect on water quality, so long as "Best Management Practices" (Missouri Watershed Protection Practices, 1990) (Waters, 1995) (MDNR, March 2000) and mitigation measures as listed in this document are implemented.

In this alternative, a portion of the Audubon Trail currently located in the floodplain would be re-located. This action would reduce the amount of sediment moving off site.

The bare ground and road/trail ruts around the Artesian well (located on National Forest land in a drainage at the intersection of Bollinger County Road 872 and Forest Road 2137 in the NW ¼, NE ¼, NW ¼, NW ¼, Section 11, T32N, R8E) permits soil movement off site. In this alternative, the trails and roads around the Artesian well would be rehabilitated and bare ground seeded. This action would reduce the amount of sediment moving off site. Also, the well site will be signed with the message "this well site has not been tested to determine if the water meets State of Missouri, drinking water standards" or some similar message.

The proposed prescribed burns, viewed at the right scale of time and space, would not have a negative impact on water quality. A low intensity, landscape prescribed burn is by nature extremely patchy. The local effect of a given prescribed burn on streams varies depending on the intensity of the fire, which is directly related to the time of the year the burn takes place. The primary concern is how the fire accelerates the delivery of sediment to the surface water system. The intensity of a wildfire could have negative effects on streams by exposing mineral soil to sheet erosion; whereas, a low intensity prescribed fire which did not burn down to mineral soil, would not contribute a significant sediment load into Saline Creek, Castor River, or Whitewater River.

There would be approximately 5.4 miles of plowed fire line that will expose mineral soil. Plowed and/or bladed fire lines could cause soil erosion and allow sediment to enter stream courses. It is critical to intercept and retain sediment between the fire line and a receiving stream. Plowed fire lines will not have an adverse effect on water quality; so long as

mitigation measures as listed in this document are implemented.

Non-Point source contaminants of non-system roads in riparian areas are most likely to contribute to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. These non-system roads within the project area would remain open under this alternative. This action would not reduce the amount of sediment moving off site on the over 40+ miles of non-system roads in the Project area.

This alternative would also allow for the removal and clean up of several dumps within the analysis area. Dump cleanup would involve using a small dozer to scoop the dump materials into a truck and refuse would be hauled off-site and disposed of properly.

Table WQ-1. Summary of activity effects for Alternative 1

Activity	Units of Measure	Potential Effects upon Water Quality
Silvicultural treatments, and associated temporary road construction or road reconstruction.	Approximately 4,669 acres silvicultural treatments. 0 miles of temp. roads. 0 miles of reconstruction.	Sediment generated by silvicultural activities could enter streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. With implementation of BMP and mitigation measures there would be no effect on MDNR designated beneficial water uses.
Relocate Audubon Trail out of floodplain.	0.6 mile.	Trails located parallel to stream courses may transport sediment to streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. Relocating trail out of floodplain will allow intercepting and retaining sediment between the site of origin and receiving stream. Therefore, there would be no effect on MDNR designated beneficial water uses.
Re-vegetation of old roads in 19 stands and bare ground and eroding soils around the Artesian well.	Approximately 5 acres.	Preventing erosion will lessen the amount of soil movement and the potential for sediment to enter stream courses. This action will help maintain MDNR designated beneficial water uses.
Sign Artesian well.	Criteria for public drinking water supply (10 CSR 20-7.031 Water Quality	The well does not meet the definition of a public water supply. Signing the site should protect public health. There would be no change in existing water quality.

Activity	Units of Measure	Potential Effects upon Water Quality
Prescribed burn and fire line construction.	Approximately 2603 acres to be burned and approx 5.4 miles of dozer line to be constructed.	Prescribe burning reduce forest floor vegetation cover. Plowed fire lines expose mineral soil. Sediment generated by these activities could enter streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. With implementation of BMP and mitigation measures there would be no effect on MDNR designated beneficial water uses.
Miles of non-system roads (abandoned roads) to be closed.	0 miles.	Abandoned roads contribute sediment to streams, which could lower water quality.
Illegal dump sites to be removed.	Approximately 11 sites.	Existing dumpsites invite oil, chemical and dead animal deposal that may pollute streams. Removal of refuse would eliminate the dumpsite that should help maintain MDNR designated beneficial water uses.

Alternative 2:

In this alternative, forest health would be accomplished with the use of commercial harvests. Nearly 90 percent of the erosion from timber harvesting can be traced to the logging road system (USEPA, 1993; MDNR, March 2000). Of primary concern is how roads accelerate the delivery of sediment to steams and rivers. Harvest areas are scattered throughout the project area and harvest activities with accompanying haul roads would occur over a 2-4 year period. This would reduce the amount of road system open in any given year, reducing runoff to only those roads being used at that time. Use of "Best Management Practices" (BMP) in constructing and maintaining skid trails and temporary roads would help reduce erosion from timber harvesting. Non-Point source contaminants of forestry activities as proposed in this alternative is not significant enough to have an adverse effect on water quality, so long as "Best Management Practices" (Missouri Watershed Protection Practices, 1990) (Waters, 1995) (MDNR, March 2000) and mitigation measures as listed in this document are implemented.

In this alternative, a portion of the Audubon Trail currently located in the floodplain would be re-located. This action would reduce the amount of sediment moving off site.

The bare ground and road/trail ruts around the Artesian well (located on National Forest land in a drainage at the intersection of Bollinger County Road 872 and Forest Road 2137 in the NW ¼, NE ¼, NW ¼, NW ¼, Section 11, T32N, R8E) permits soil movement off site. In this alternative, the trails and roads around the Artesian well would be rehabilitated and bare ground seeded. This action would reduce the amount of sediment moving off site. Also, the well site will be signed with the message "this well site has not been tested to determine if the water meets State of Missouri, drinking water standards" or some similar message.

The proposed prescribed burns, viewed at the right scale of time and space, would not have a negative impact on water quality. A low intensity, landscape prescribed burn is by nature extremely patchy. The local effect of a given prescribed burn on streams varies depending on the intensity of the fire, which is directly related to the time of the year the burn

takes place. The primary concern is how the fire accelerates the delivery of sediment to the surface water system. The intensity of a wildfire could have negative effects on streams by exposing mineral soil to sheet erosion; whereas, a low intensity prescribed fire which did not burn down to mineral soil, would not contribute a significant sediment load into Saline Creek, Castor River, or Whitewater River.

There would be approximately 5.4 miles of plowed fire line that will expose mineral soil. Plowed and/or bladed fire lines could cause soil erosion and allow sediment to enter stream courses. It is critical to intercept and retain sediment between the fire line and a receiving stream. Plowed fire lines will not have an adverse effect on water quality; so long mitigation measures as listed in this document are implemented.

Non-Point source contaminants of non-system roads in riparian areas are most likely to contribute to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. In this alternative, these non-system roads would be closed, water bars installed, and vegetated. This action would reduce the amount of sediment moving off site on approximately 40+ miles of non-system roads in the Project area and help maintain MDNR designated beneficial water uses for the Castor River and Saline Creek.

This alternative would also allow for the removal and clean up of several dumps within the analysis area. Dump cleanup would involve using a small dozer to scoop the dump materials into a truck and refuse would be hauled off-site and disposed of properly.

Table WQ-2. Summary of activity effects upon water quality for Alternative 2

Activity	Units of Measure	Potential Effects upon Water Quality
Silvicultural treatments, and associated temporary road construction or road reconstruction	Approximately 4730 acres silvicultural treatments. Approximately 24.3 miles of temp. roads. Approximately 8.3 miles of reconstruction.	Sediment generated by silvicultural treatments and associated roads could enter streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. With implementation of BMP and mitigation measures there would be no effect on MDNR designated beneficial water uses.
Relocate Audubon Trail out of floodplain.	0.6 mile to be relocated.	Trails located parallel to stream courses may transport sediment to streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. Relocating trail out of floodplain will allow intercepting and retaining sediment between the site of origin and receiving stream. Therefore, there would be no effect on MDNR designated beneficial water uses.

Activity	Units of Measure	Potential Effects upon Water Quality
Re-vegetation of old roads in 19 stands and bare ground and eroding soils around the Artesian well.	Approximately 5 acres.	Preventing erosion will lessen the amount of soil movement and the potential for sediment to enter stream courses. This action will help maintain MDNR designated beneficial water uses.
Sign Artesian well.	Criteria for public drinking water supply (10 CSR 20-7.031 Water Quality Standards).	The well does not meet the definition of a public water supply. Signing the site should protect public health. There would be no change in existing water quality.
Prescribed burn and fire line construction.	Approximately 2603 acres to be burned and approximately 5.4 miles of dozer line to be constructed.	Prescribe burning reduce forest floor vegetation cover. Plowed fire lines expose mineral soil. Sediment generated by these activities could enter streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate. With implementation of BMP and mitigation measures there would be no effect on MDNR designated beneficial water uses.
Miles of non-system roads (abandoned roads) to be closed.	Approximately 40 miles.	Abandoned roads contribute sediment to streams, which could lower water quality. Non-system roads would be closed, water bars installed, and vegetated. This action will help maintain MDNR designated beneficial water uses.
Illegal dump sites to be removed	Approximately 11 sites.	Existing dumpsites invite oil, chemical and dead animal deposal that may pollute streams. Removal of refuse would eliminate the dumpsite that should help maintain MDNR designated beneficial water uses.

Alternative 3 (No Action):

In this alternative, current and on-going activities would continue and significant public health and safety issues would be addressed.

In this alternative, there would be no silvicultural treatments and associated temporary road construction or road reconstruction.

In this alternative, a portion of the Audubon Trail currently located in the floodplain would not be re-located. This action would not reduce the amount of sediment moving off site.

In this alternative, the trails and roads around the Artesian well and other sites would not be rehabilitated. This action would not reduce the amount of sediment moving off site. For public health and safety, the Artesian well site will be signed with the message this well site has not been tested to determine if the water meets State of Missouri, drinking water

standards or some similar message.

In this alternative, there would be no prescribed burns to improve wildlife habitat or reduce fuel buildup.

Non-Point source contaminants of non-system roads in riparian areas are undoubtedly contributing to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. These non-system roads within the project area would remain open under this alternative. This action would not reduce the amount of sediment moving off site.

In this alternative, the dumpsites would not be cleaned up and rehabilitated.

Table WQ-3. Summary of activity effects upon water quality for Alternative 3

Activity	Units of Measure	Potential Effects upon Water Quality
Silvicultural treatments, and associated temporary road construction or road reconstruction.	Approximately 0 acres silvicultural treatments. Approximately 0 miles of temp. roads. Approximately 0 miles of reconstruction.	There would be no effect on MDNR designated beneficial water uses.
Relocate Audubon Trail out of floodplain.	0 mile to be relocated.	Trails located parallel to stream courses may transport sediment to streams and alter natural relationships between the biota and the stream substrate by changing the condition of the substrate; however, this action by itself would not likely effect MDNR designated beneficial water uses.
Re-vegetation of old roads in 19 stands and bare ground and eroding soils around the Artesian well.	0 acres to be re-vegetated.	Soil erosion may find it way to stream courses in the way of sediment, which could alter natural relationships between the biota and the stream substrate by changing the condition of the substrate; however, this action by itself would not likely effect MDNR designated beneficial water uses.
Sign Artesian well.	Criteria for public drinking water supply (10 CSR 20-7.031 Water Quality Standards).	The well does not meet the definition of a public water supply. Signing the site should help protect public health.
Prescribed burn and fire line construction.	Approximately 0 acres to be burned and approximately 0 miles of dozer line to be constructed.	There would be no effect on MDNR designated beneficial water uses.

Activity	Units of Measure	Potential Effects upon Water Quality
Miles of non-system roads (abandoned roads) to be closed.	0 miles.	Abandoned roads contribute sediment that could alter natural relationships between the biota and the stream substrate by changing the condition of the substrate; however, this action by itself would not likely effect MDNR designated beneficial water uses.
Illegal dump sites to be removed.	0 sites.	Existing dumpsites invite oil, chemical and dead animal disposal that may pollute streams. Failure to remove dumps could adversely affect water quality.

WATER QUALITY - CUMULATIVE EFFECTS

The area considered for cumulative effects is Saline Creek, Castor River, and Whitewater River. The time period considered for cumulative effects is the next 10 years.

Public lands total 17,178 acres (17 %) of the Project Area. Therefore, during the next decade, non-federal landowners will determine land uses on approximately 84,309 acres (83%) within the Project Area. Conversion from timber to other land uses would involve persistent increases of water yield, storm flow, and sediment yield, and usually include increased inputs of nutrients and bacteria. Non-federal lands are a mixture of open pastures, developed areas, and forest. The approximately 1,200-acre Amidon State Conservation Area is located within the Project Area along the Castor River about six miles due east of Fredericktown. Water quality will depend in large part on how non-federal lands are managed; especially non-federal riparian areas. Potential Point Source Pollution include: discharges from municipal waste water treatment plants, sedimentation of downstream habitats from sand and gravel removal operation, headcutting of streams from channelization, and illegal dump sites. Potential Non-point Source Pollution includes rural septic tanks, runoff of nutrients from pastures, sedimentation of downstream habitats from road and bridge construction, operation, and maintenance; and pesticide or fertilizer runoff from fields. It will take the cooperation of all landowners within the watersheds of the project area to minimize Point and Non-point pollution and its impacts.

The FY 2002 Monitoring and Evaluation Report indicate the Forest Plan's Standards and Guidelines for maintenance of water quality on timber management projects are effective. The guidelines provide for buffer zones around riparian areas, and prevent excessive soil disturbing activities in areas that could be prone to excessive erosion.

Alternative 1 and 2:

Watershed are classified and have designated beneficial uses as presented in Tables G and H of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality (MDNR, August 2000). These waters must meet or exceed established criteria as defined in Table A of the Rules of the Department of Natural Resources Division 20-Clean Water Commission Chapter 7-Water Quality for those beneficial uses (MDNR, August 2000). Forest Service actions as described in Alternative 1 & 2 would cause no changes to water quality associated with Saline Creek, Castor River, and Whitewater River which

would impair MDNR designated uses; provided Forest Plan standard and guides and mitigation measures for either action alternative is implemented. In fact, in alternative 2, closing non-system roads and ORV user-developed trails may reduce the amount of sediment entering watercourses.

Alternative 3: No Action

In this alternative current and on-going activities would continue, but no new management activities would be initiated on National Forest land. Siltation tops the list of the foremost 10 pollutants in rivers, half-again higher than the 2nd most important pollutant, nutrients (USEPA, 1993; Waters, 1995). Over a 10-year period, Non-Point source contaminants of non-system roads (approximately 40+ miles) and trails (0.6 mile) could contribute to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. These non-system roads within the project area would remain open under this alternative. Over this 10-year period, the amount of sediment entering stream water courses would most likely increase; however, it is doubtful this action by itself would cause changes to water quality associated with Saline Creek, Castor River, and Whitewater River which would impair MDNR designated uses.

Mitigation:

Impacts from implementation of any action alternative would be indirect and non-significant provided mitigation measures SW1, SW2, SW3, SW4, SW5, SW6, SW7, SW8, SW9, and the standard and guides in the Forest Plan are followed.

Monitoring:

Sign the Artesian well site saying “this well site has not been tested to determine if the water meets State of Missouri, drinking water standards” or some similar message.

The Castor River and Saline Creek are considered reference streams for the Ecological Drainage Units (EDU) established by MDNR. It is expected MDNR will take additional biological and chemical samples during and after project implementation. These samples will be compared to existing conditions to determine what biologically and water quality values may have change and if project implementation may have been the cause for any change.

Project level monitoring is designed to determine whether or not the resource management objectives of the environmental analysis have been implemented as specified and whether or not the measures for mitigating the environmental effects were effective.

Implementation monitoring of project recommended mitigation measures and other project actions will be conducted.

Forest-wide project implementation audits would be conducted by Forest resource staff on a sample of randomly selected project areas on an annual basis. The East Fredericktown project area could be included in this sample at any time and at any stage of the project planning and implementation process.

WILDLIFE - EXISTING CONDITIONS OF WILDLIFE

Forest Plan Habitat Objectives for Wildlife

The Forest Plan identifies eight habitat objectives that are to be used to indicate viable populations of terrestrial wildlife on the Mark Twain National Forest. Each habitat objective represents a particular forest condition that projects should strive to achieve in order to ensure ongoing viability of wildlife species on the Forest. This

does not necessarily mean that projects must achieve these habitat conditions within the 10-year planning period, but rather, that each project planned on the Forest should either move the area toward these conditions or, at least, not preclude moving the area toward them in the future.

There are two levels of habitat objectives established in the Forest Plan for achieving and maintaining terrestrial wildlife species' viability. One level represents the Minimum Viable Population (MVP) level. The MVP level represents the minimum percentage of a habitat condition that should be provided within a particular Landtype Association (LTA) in order for species' viability to be maintained. The MVP habitat objectives for each LTA are identified on pages IV-59 through IV-65 in the Forest Plan. Projects that cause a particular habitat condition to fall below the MVP may jeopardize the viability of some species on National Forest within that particular LTA.

The second level represents the Desired Future Condition (DFC) level. A DFC level has been established for most of the Management Prescriptions (MP) on the Forest and their respective LTAs. The DFC level represents the percentage of a habitat condition that is desired within a particular LTA in order for that LTA to provide the optimum amount of habitat necessary to ensure all species' viability. Projects should be planned with an objective of moving the analysis area toward the DFC for each LTA.

Within the East Fredericktown analysis area, there are four Management Prescriptions as follows:

MP	Acres in Analysis Area	% of Analysis Area
4.1	16,666	96%
8.1	628	4%
9.1	13	< 1%
6.3	18	< 1%
SUM	17,325	100%

***acres are approximate, and represent only National Forest lands**

The majority (96%) of the analysis area is within the 4.1 MP. This Management Prescription includes three LTAs, only 2 of which are within the analysis area. These two LTAs are the Oak-Pine Hills and Oak-Pine Plains, and each respectively represents approximately 82% and 18% of the 4.1 MP within the analysis area.

The 4.1 MP general objective for wildlife is to provide habitats for native and naturalized fish and wildlife common to the area while emphasizing habitat associated with early and mid-successional stages of plant community development and with the shortleaf pine forest (FLRMP IV-128). Table WL-1 identifies the eight wildlife habitat objectives for the Oak-Pine Hills and Oak-Pine Plains LTAs when they occur within the 4.1 MP.

Table WL-1. Forest Plan wildlife habitat objectives that have been established for the Oak-Pine Hills and Plains LTAs when they occur within the 4.1 Management Prescription.

Habitat Objective	MVP	DFC	Existing Forest-wide Levels within Oak-Pine Hills & Plains LTAs*	Existing Analysis Area Levels within the 4.1 MP Oak-Pine Hills & Plains LTAs**	Need for change
1. Woodland habitat in the 0-9 year age class	4%	8-15%	4%	2.7%	Increase
2. Woodland habitat in the old growth condition	5%	8-10%	3%	4.4%	Increase
3. Woodland habitat in the oak and oak-pine types over 50 years of age	25%	30-40%	50%	62%	Decrease
4. Woodland habitats in pole and sawtimber size classes with crown closure over 80 %	20%	35-45%	54%	74%	Decrease
5. Woodland sawtimber habitat in the oak, oak-pine, and pine type that has a condition of 20-30% forbs, grass, and shrub ground cover	20-30%	25-35%	Below required	8.5%	Increase
6. Woodland habitat in the oak type over 50 years of age with dense understory	10%	10-15%	9%	9.5%	Maintain/Increase
7. Open and semi-open habitat	1%	4-10%	7%	1.7%	Increase
8. Permanent water sources per square mile	1 per sq. mile	1-2 per sq. mile	Unknown	0.8 per sq. mile	Increase

*** source: FY 2002 MTNF Monitoring & Evaluation Report, p. 19.**
****source: Queries from CDS using MTNF CDS query standards by Houf et.al.; CDS data from May 2003; total acres in 4.1 MP in analysis area = 16, 666 (from cds_hap report 1b 16Oct03)**

The existing levels within the 4.1 MP of the analysis area indicate that the current condition within the analysis area reflect the current conditions across the Oak-Pine Hills and Plains LTAs forest-wide. The levels show a heavily forested, aging forest condition in which a majority of the forest is greater than 50 years of age and has > 80% canopy cover. As would be expected given these dense forest conditions, the levels of more open forest habitat are considered low and should be increased in order to provide for species that require open areas with a dense grass or shrub understory. The levels of 0 to 9 year old forest, of forest in an old growth condition, and sawtimber forest with 20-30% forb and shrub ground cover are particularly low and need to be increased forest-wide. Currently, these habitat conditions are below the minimum identified as necessary in the Forest Plan for ensuring some species' viability.

The other MP that represents more than 1% of the analysis area is the 8.1 MP. This MP was established for "special areas" other than wilderness. These special areas exist for the protection of unusual environmental, recreational, cultural, or historical resources, and for scientific or educational studies. New

areas may be added to this prescription as they are evaluated (FLRMP IV-193).

Within the analysis area, only 628 acres are within the 8.1 MP and all fall within the Oak-Pine Hills LTA. These 8.1 MP acres primarily represent "Salamander Hollow," a bottomland riparian forest that is considered a candidate for State Natural Area status. Also included in this 8.1 MP are the "Bidwell Creek glade" and "Wash Creek fen," also being considered for State Natural Area status (FLRMP IV-195).

Few wildlife habitat objectives have been established for the 8.1 MP. Habitat manipulation within the MP areas is normally limited to the needs of threatened, endangered, rare, or sensitive species and species of concern. Natural ecological processes are normally allowed to prevail (FLRMP IV-198).

The remaining two MPs that are within the analysis area (the 6.3 and 9.1 MPs) are not discussed in detail in this analysis because they represent less than 1% of the analysis area.

Roads and Wildlife

Currently, the analysis area contains several hundred miles of maintained and unmaintained roads. The majority of these roads are state or county roads (refer to Table WL-2). The presence of roads can directly affect habitat for many species. Direct effects can include habitat loss and fragmentation, edge effects, and increased mortality and disturbance of wildlife.

Table WL-2. Approximate miles of roads within the analysis area.

Type of road	Approximate miles
State Highways	53
County Roads	80
Forest Service System Roads	33.8
Non-system roads on National Forest	50
Private roads (not on National Forest)	106
Total Miles	322.8

Source: Roads analysis, A. Sullivan (7/24/03); Roads shapefile query by S. Owen (9/25/03)

Different wildlife species are affected by road systems in different ways, depending upon their habitat requirements and general life histories and behaviors. Various studies have indicated that, depending upon the species involved, some wildlife species are more tolerant of roads than others. Roads tend to create a distinct habitat, generally favorable to species that prefer edge habitats. For forest interior species, this could be detrimental; whereas, for other species, this may increase the amount of suitable habitat available to them.

"Road density" is often a useful index to determine the effect of roads on wildlife populations. High road densities in an area are often associated with a variety of negative human effects on several wildlife species (US Forest Service 2000). Even in a landscape of high average road density, a few large areas of low road density may be the best indicator of suitable habitat for large vertebrates (US Forest Service 2000). In the Adirondacks, for instance, the population of black bears was found to be inversely related to road density (US Forest Service 2000). Mountain lions have been found to establish home ranges in areas with lower road densities than the average in an area (Ercelawn 1999).

Another index associated with road density that may be used to determine the effects of roads

on wildlife is the "road effect zone". The "road effect zone" is the zone or distance from a road in which wildlife species are directly or indirectly affected by activities occurring on or along the road. The effects of roads can extend some distance from their centers, so that their "effective widths" can be many times their actual widths. Research has determined that this "road effect zone" varies depending upon the type of wildlife species being considered. For example, in a Tennessee study, researchers found a 60% decrease in arthropods within 50 ft (15 m) of roads (King and DeGraaf 2002). Other research indicates that large mammals tend to avoid roads and areas within 328 to 656 ft (100 to 200 m) of roads (Ercelawn 1999). Depending upon the edge habitat created by a road, some birds have been found to avoid habitat within 328 ft (100 m) of a forest edge and have lower nesting success within 164 ft (50 m) of forest edges (Ercelawn 1999). Other studies, however, have indicated that nest survival for some forest interior birds does not differ within 492 ft (150 m) and beyond 492 ft (150 m) from maintained forest roads (King and DeGraaf 2002), so further research in this area is warranted.

The type of road design and use also plays a key role in the effects of roads upon wildlife. Roads that are paved and have high traffic volumes, in which traffic is traveling at a high rate of speed, would be expected to have a greater "road effect zone" than unpaved roads with low traffic volumes. Black bears, for example, have been found to almost never cross heavily used roads, but cross roads with little traffic more frequently (Ercelawn 1999). Bobcats have also been found to cross paved roads less than expected (US Forest Service 2000). Small mammals, amphibians, and reptiles also are influenced by road conditions and traffic use. Some roads have been determined to be barriers to movement of eastern chipmunks and white-footed mice, and frog and toad density near paved roads has been found to decrease with increasing traffic density (Ercelawn 1999).

Road width also has an influence on its effect upon wildlife and their habitat. Generally speaking, the wider the road, the greater the edge effect it may have upon wildlife species. This may also be influenced by the surrounding landscape adjacent to the road. Roads that are wide enough to create a large gap in the forest canopy, for instance, could potentially fragment habitat for canopy-dependent birds and wildlife species and create corridors by which predators can enter the forest and affect wildlife populations (US Forest Service 2000). In general, biological invasion of predators and undesirable edge species, whether they be plant or animal, is another negative effect of extending roads into forest interiors (US Forest Service 2000).

With regards to forest fragmentation, one group of species that tends to be of great concern is the forest-interior birds. This group represents birds that tend to prefer large tracts of contiguous, mature forest, located away from edge habitats and openings. Where this habitat does become fragmented by edge and openings, these species may be especially vulnerable to cowbird nest parasitism and general nest predation. In a study conducted by King and DeGraaf (2002), the effect of forest roads on the reproductive success of forest-dwelling passerine birds was studied. The results of this research indicated that small ($\leq$ 26 ft; 8 m wide) forest roads had no negative effects upon the reproductive success of forest passerine birds nearby, and that there was no evidence that ovenbirds, a species known to be sensitive to fragmentation, actively avoided nesting near roads within this width range. While there may be some consensus that the effects of forest roads varies with road width and density, this study by King and DeGraaf indicated that roads $\leq$ 26 ft (8 m) wide, and areas with a road density $\leq$ 2.7 mi/sq.mi (1.7 km/km2), are below the threshold at which significant negative effects on forest birds appear.

In this analysis, the road width and type of road design were taken into account when determining a "road effect zone" for each alternative. It has been assumed in this analysis that the State and County roads have an effective width of 656ft (200m), Forest System roads have an effective width of 328 ft (100m) and non-system roads have an effective width of 164 ft (50m) extending from either side of the road. Temporary roads were not included in calculating "road effect zones" because they are generally < 26 ft (8 m) wide and are temporary in nature.

Management Indicator Species

Also identified in the Forest Plan are several species considered to be indicators of the general forest condition and its ability to provide for overall wildlife species' viability. These species are considered Management Indicator Species (MIS) and have been identified for each LTA. For the Oak-Pine Hills and Plains LTAs, nine MIS species have been identified (refer to Table WL-3).

Table WL-3. Management indicator species for the East Fredericktown analysis area.

Pileated woodpecker	White-tailed deer	Ruffed grouse
Ovenbird	Raccoon	Bobcat
Wild turkey	Wood thrush	Indigo bunting

These MIS are connected to many of the habitat objectives that have been identified in the Forest Plan. Refer to Table WL-4 for a crosswalk of the MIS and their associated habitat objectives.

Table WL-4. Forest Plan wildlife habitat objectives that have been established for the Oak-Pine Hills and Plains LTAs and the MIS that are associated with each of these objectives.

Habitat Objective	**MIS that would be expected to utilize this habitat condition**
1. Woodland habitat in the 0-9 year age class	Wild turkey, White-tailed deer, Ruffed grouse, Indigo bunting
2. Woodland habitat in the old growth condition	Pileated woodpecker, Wild turkey, White-tailed deer, Raccoon, Wood thrush, Bobcat
3. Woodland habitat in the oak and oak-pine types over 50 years of age	Pileated woodpecker, Ovenbird, Wild turkey, White-tailed deer, Raccoon, Wood thrush, Bobcat
4. Woodland habitats in pole and sawtimber size classes with crown closure over 80 %	Pileated woodpecker, Wild turkey, White-tailed deer, Raccoon, Wood thrush, Bobcat
5. Woodland sawtimber habitat in the oak, oak-pine, and pine type that has a condition of 20-30% forbs, grass, and shrub ground cover	Pileated woodpecker, Ovenbird, Wild turkey, White-tailed deer, Raccoon, Wood thrush, Ruffed grouse, Bobcat, Indigo bunting
6. Woodland habitat in the oak type over 50 years of age with dense understory	Pileated woodpecker, Ovenbird, Wild turkey, White-tailed deer, Raccoon, Wood thrush, Ruffed grouse, Bobcat, Indigo bunting
7. Open and semi-open habitat	Wild turkey, White-tailed deer, Raccoon, Ruffed grouse, Bobcat, Indigo bunting
8. Permanent water sources	Wild turkey, white-tailed deer, raccoon, Bobcat

It is important that the Mark Twain National Forest monitor the population trends of these MIS in order to evaluate the effectiveness of planned activities and how these activities may influence MIS populations. Table WL-5 shows the most recent information regarding MIS population trends for the period of 1980 to 2000.

Table WL-5. Population trends of MIS from 1980-2000.

MIS	Trend Statewide	Trend on the Ozark-Ouachita Plateau (contains most of the MTNF)
Pileated woodpecker	Declining	Increasing
Ovenbird	Increasing	Increasing
Wild Turkey	Declining	Declining
Wood thrush	Increasing	Increasing
Ruffed Grouse	Declining	Declining
Indigo bunting	Declining	Increasing
White-tailed deer	Stable	Stable
Raccoon	Stable	Stable
Bobcat	Stable	Stable

Source: FY 2002 MTNF Monitoring & Evaluation Report, p. 20

Based upon the information in Table WL-5, MIS that may be declining on the Mark Twain National Forest are wild turkey and ruffed grouse. Reasons for these declines are not fully known. Although wild turkey populations may be declining, they are still considered a relatively common species on the National Forest and are frequently hunted. Ruffed grouse are uncommon on the National Forest, despite several reintroduction attempts, and it has been suggested that there is more habitat for ruffed grouse today than there are grouse available to occupy it (Jacobs and Wilson 1997).

For this analysis, it is assumed that the population levels of MIS within the East Fredericktown analysis area are the same as the population levels identified in Table WL-5 for the Ozark-Ouachita Plateau. Field surveys conducted in preparation of this analysis indicated that all of these MIS have habitat within the analysis area. Seven of these MIS (pileated woodpecker, ovenbird, wild turkey, wood thrush, indigo bunting, white-tailed deer and raccoon) were documented within the analysis area during field surveys for this project and many, such as the pileated woodpecker, white-tailed deer, and indigo bunting, seemed to be relatively common (L.Mills, pers. observation).

FEDERALLY THREATENED & ENDANGERED SPECIES

The Forest Service is legally required to provide protection to insure survival of federally listed species. In Missouri, twelve federally listed species are considered to have habitat or known populations on the Mark Twain National Forest. These species and their most current population trends in Missouri are identified in Table WL-6.

Table WL-6. Federally listed species considered and their population trends in Missouri.

Species	Trend	Species	Trend
Gray bat	Stable	Scaleshell mussel	Decreasing
Indiana bat	Decreasing	Tumbling Creek cavesnail	Decreasing
Bald eagle	Increasing	Ozark hellbender	Decreasing
Topeka shiner (fish)	Decreasing	Hine's emerald dragonfly	Unknown
Curtis' pearlymussel	Decreasing, may be extirpated	Running buffalo clover	Stable
Pink mucket pearlymussel	Stable	Mead's milkweed	Decreasing

Source: FY 2002 MTNF Monitoring & Evaluation Report, p. 21

The US Fish and Wildlife Service identified these twelve species in a letter to the Forest Supervisor, dated 31 July 2002. Of these twelve species, seven are considered likely to occupy the East Fredericktown analysis area (Table WL-7).

Table WL-7. Federally listed species considered likely to occur or have habitat within the East Fredericktown analysis area.

Status	Common Name	*Associated habitat in the analysis area*
Threatened	Bald eagle	Forest along large streams, reservoirs and lakes
Endangered	Curtis' pearlymussel	Little Black & Castor Rivers
Endangered	Gray bat	Caves; riparian areas
Endangered	Indiana bat	Caves; forests
Endangered	Hine's emerald dragonfly	Groundwater fed, limestone or dolomite grassy wetlands or fens
Endangered	Running buffalo clover	Open, well-lit stream sides
Threatened	Mead's milkweed	Igneous glades

Federally listed species described in the Missouri Fish and Wildlife Information System (MOFWIS) as known or likely to occur in St. Genevieve, St. Francois, Bollinger, and Madison counties are Curtis' pearlymussel, bald eagle, and running buffalo clover (as of 7/23/03). A review of the MTNF Heritage database (6/24/03 ver 1.2) also indicated the presence of gray and Indiana bats within one or more of these counties. The MTNF BE Program documented the known or likely

presence of Indiana bat within one (LTA HA) of the four LTAs for the East Fredericktown analysis area (BE Program Report 2, 7/28/03). Based upon a review of these databases, as well upon information from field surveys, none of these species are known to occur within the analysis area.

Additional information regarding these species can be found in the federally listed species BAE prepared for the East Fredericktown analysis area, dated 6 August 2003 (see Appendix A).

REGIONAL FORESTER'S SENSITIVE SPECIES AND OTHER SPECIES OF CONCERN

Regional Forester's Sensitive Species (RFSS) considered in this analysis are those included in the list dated 2/29/2000. In addition, four species added to the RFSS list on 10/23/2003 are also considered. Overall, 131 current or former RFSS plants and animals were considered. Of these 131 species, 60 species (30 animals, 30 plants) are likely or known to occur on the Potosi-Fredericktown District.

A review of field surveys, the Missouri Fish and Wildlife Information System (MoFWIS) for Ste. Genevieve, St. Francois, Madison, and Bollinger Counties, Missouri, plus a review of the Missouri Heritage 2003 (6/24/03, ver. 1.2) database, and the MTNF BE Program for the two LTAs in the project area indicated that the following RFSS are known or likely to occur in the East Fredericktown analysis area:

Table WL-8. Former and current Regional Forester's Sensitive Species likely or known to occur within the analysis area. Species' common names in bold have been documented in the analysis area; species' common names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area.

Common Name	*Scientific Name*	Species Group	Habitat
Ozark snaketail dragonfly	*Ophiogomphus westfalli*	Insect	Riparian/Streams/Rivers
A heptogeniid mayfly	*Stenonema bednariki*	Insect	Streams/Rivers
Dioecious sedge	*Carex sterilis*	Plant	Riparian/Fen/Seep
Goldie's woodfern	*Dryopteris goldiana*	Plant	Riparian/Fen/Seep
Butternut	*Juglans cinerea*	Plant	Riparian/Forest/Slope
Spotted phlox	*Phlox maculate pyramidalis*	Plant	Riparian/Fen/Seep
Small green woodland orchid	*Platanthera clavellata*	Plant	Riparian/Fen/Seep
Moss	*Seligeria donniana*	Plant	Riparian
Bachman's sparrow	*Aimophila aestivalis*	Bird	Glade/Grassland
Cerulean warbler	*Dendroica cerulea*	Bird	Riparian/Forest/Slope
Peregrine falcon	*Falco peregrinus anatum*	Bird	Grassland

Common Name	*Scientific Name*	Species Group	Habitat
Migrant loggerhead shrike	*Lanius ludovicianus migrans*	Bird	Grassland
Western sand darter	*Etheostoma clarium*	Fish	Streams/Rivers
Blacknose shiner	*Notropis heterolepis*	Fish	Streams/Rivers
Ozark shiner	*Notropis ozarcanus*	Fish	Streams/Rivers
Longnose darter	*Percina nasuta*	Fish	Streams/Rivers
Snuffbox	*Epioblasma triquetra*	Mollusc	Rivers
Rabbitsfoot	*Quadrula cylindrica*	Mollusc	Rivers
Purple lilliput	*Toxolasma lividus*	Mollusc	Rivers
Big Creek crayfish	*Orconectes peruncus*	Mollusc	Streams/Rivers
Big River belted crayfish	*Orconectes harrisonii*	Mollusc	Streams/Rivers
St.Francis River crayfish	*Orconectes quadruncus*	Mollusc	Streams/Rivers
Forked aster	*Aster furcatus*	Plant	Bluff
Epiphytic sedge	*Carex decomposita*	Plant	Wetland/Seeps/Fens
Open ground Whitlow grass	*Draba aprica*	Plant	Riparian/Bluffs
Wavy-leaf purple coneflower	*Echinacea simulata*	Plant	Glade/Grassland
Large-leaved grass of Parnassus	*Parnassia grandifolia*	Plant	Riparian/Wetland/Seeps/Fens
Gattinger's goldenrod	*Solidago gattingerii*	Plant	Glade
Ozark cornsalad	*Vallerianella ozarkana*	Plant	Glade
Sand grape	*Vitus rupestris*	Plant	Riparian

Source: MoFWIS report 7/23/03; BE Program reports run 7/24/03

In addition to these RFSS species, other Species of Concern have no Regional Forester or federal status; yet, are considered in this evaluation because they have some type of state designation that determines they are at risk in Missouri or throughout their range. These species were identified for the Mark Twain National Forest using the Missouri Fish and Wildlife Information System (MoFWIS) 7/13/00 and Wildlife Code of Missouri (3/1/02).

A review of this list using MoFWIS, the BE Program and the MTNF Heritage CD (6/24/03 ver. 1.2) indicated that, of all these Species of Concern, only the following would be expected to occur within the East Fredericktown analysis area because these species are known to occur statewide or within the range of the analysis area.

Table WL-9. Additional Species of Concern known or likely to occur in the analysis area. Species' common names in bold have been documented in the analysis area; species' common names not in bold are considered known or likely, according to BE Program & MOFWIS, but have not been documented within the analysis area.

Common Name	*Scientific Name*	Species Group	Habitat
Spotted skunk	*Spilogale putorius interrupta*	Mammal	Grassland
Flathead chub	*Platygobio gracilis*	Fish	Streams/Rivers
Harlequin darter	*Etheostoma histrio*	Fish	Streams/Rivers
Taillight shiner	*Notropis maculates*	Fish	Streams/River
Eastern prairie fringed orchid	*Platanthera leucophaea*	Plant	Extirpated
Snowy egret	*Egretta thula*	Bird	Wetland
Northern harrier	*Circus cyaneus*	Bird	Grassland
Barn owl	*Tyto alba*	Bird	Grassland
King rail	*Rallus elegans*	Bird	Wetland
American bittern	*Botaurus lentiginosus*	Bird	Wetland

Additional information regarding these species can be found in the RFSS and Species of Concern BAE prepared for the East Fredericktown analysis area, dated 16 September 2003 (see Appendix A).

SPECIALIZED HABITATS

The Forest Plan identifies many species that are associated with specialized habitats across the National Forest. Ongoing protection and maintenance of these specialized habitats is essential in maintaining the viability of these species and, thus, ensuring overall forest biodiversity. Species requiring these specialized habitats will receive priority when encountered (FLRMP IV-51). Table WL-10 shows specialized habitats that are recognized in the Forest Plan and are known to occur within the East Fredericktown analysis area.

Table WL-10. Specialized habitats in the East Fredericktown analysis area and their associated high priority species.

Specialized Habitat	Associated Priority Species (Species in bold were documented from the analysis area during recent field surveys)
Springs, seeps and fens	Oklahoma salamander, four-toed salamander, longtailed salamander, dark-sided salamander, cave salamander, graybelly salamander, Ozark zig-zag salamander, **southern red-backed salamander**, slimy salamander, grotto salamander
Riparian areas	No species identified.
Bottomland hardwood forests	Swamp rabbit, Swainson's warbler, Kentucky warbler, great blue hero great egret, black-crowned night heron, yellow-crowned

	night heron, Acadian flycatcher, **hooded warbler**
Specialized Habitat	**Associated Priority Species** (Species in bold were documented from the analysis area during recent field surveys)
Glades	Grasshopper sparrow, Bachman's sparrow, Texas mouse, greater roadrunner, common nighthawk, eastern collard lizard, eastern narrowmouth toad, six-lined racerunner, northern lined snake, eastern coachwhip snake, great plains rat snake, red milk snake, northern scarl snake, ground snake, flathead snake, western worm snake, western pygmy rattlesnake, Texas horned lizard, souther coal snake, ornate box turtle
Shortleaf pine forest	Cooper's hawk, red-cockaded woodpecker, sharp-shinned hawk, long eared owl, **pine warbler**, brown-headed nuthatch
Fishless ponds and temporary pools	Ringed salamander, **spotted salamander**, marbled salamander, **centra newt**, **American toad**, **Blanchard's cricket frog**, **northern spring peeper**, **Cope's gray treefrog**, eastern narrowmout toad, **southern leopard frog**, **wood frog**

BIRDS (EMPHASIZING NEOTROPICAL MIGRANTS)

The East Fredericktown analysis area offers a wide variety of habitats, nearly all of which are occupied by various neotropical migratory birds during the spring through fall months. Many of these neotropical migrants breed within the analysis area. Approximately 305 species of birds are likely to be found within the analysis area (MoFWIS). Of these 305 species, approximately 148 species would be considered likely to use the analysis area regularly as breeding habitat and approximately one-third of these species that may breed in the analysis area are considered neotropical migrants (Jacobs and Wilson 1997). Many other neotropical migrants may not breed in the analysis area, but do use the area as "stopover" habitat during their migration to summer and wintering grounds.

Neotropical migrant birds, as well as many other bird species, are susceptible to a wide variety of factors that may influence their populations. Two of the most recognized management issues that have been determined to be important to maintaining populations of breeding birds, especially neotropical migrants, are:

-Avoiding fragmentation and loss of suitable breeding habitat, particularly forest habitat

-Monitoring & limiting opportunities for nest predation and parasitism by brown-headed cowbirds and other wildlife.

Regarding fragmentation of forest habitat, the analysis area is represented predominantly by mature oak-hickory forest and a variety of other habitats. Approximately 80% of the analysis area (including private lands) is forested, with the remaining 20% containing mostly agricultural and pastural private lands. Habitat availability within the analysis area for most birds species is shown in Table WL-11.

Table WL-11. Habitat availability for birds within the East Fredericktown analysis area.

Birds associated with the following habitats	% of Birds in Ozark/ Ouachita physiographic area that are likely to occupy this habitat	Abundance of habitat within the analysis area
Wetland or riparian areas	13%	Not limited. Habitat present along many miles of stream within the analys area
Grassland or glades	17%	Limited. Habitat present is marginal, and represented by private hay fields & unburned glades.
Forests of various age classes	43%	Abundant. 80% of analysis area is forested. Early successional forest & scrub-shrub habitat is limited.
No specific habitat	27%	N/A

Source: Fitzgerald and Pashley 2000

As indicated in Table WL-11, the majority of birds within the analysis area would be species associated with forests. Habitat for closed-canopy forest-dwelling birds is not limited within the analysis area and is contiguous with both forested private lands and National Forest. Habitat for open-canopy, forest-dwelling birds, and birds that occupy scrub-shrub and early successional forests is limited, especially on private lands. Habitat for these species is most likely provided on National Forest in the analysis area, and based upon the existing percentage of habitat in the 0 to 9 year age class (2.7%) and in open or semi-open conditions (1.7%), habitat for these species on National Forest is also somewhat limited. Species that occupy these scrub-shrub habitats are mostly relegated to roadsides, abandoned fields, and powerline corridors within the analysis area. Many bird species prefer riparian habitat in the form of forested stream and river corridors. This habitat is provided within the analysis area on private and National Forest lands that are adjacent to the many miles of streams within the analysis area, and along the Castor River. Bird species that prefer grasslands are not well provided for within the analysis area and would be most likely restricted to hay fields and some larger glades within the analysis area.

The level of nest parasitism and cowbird parasitism that is occurring within the analysis area is unknown. Within the Ozark/Ouachita Physiographic area (which includes the East Fredericktown analysis area), reproductive success of forest-breeding birds appears to be above that needed to sustain local populations, and offspring from birds breeding in the physiographic area may be the sources of individuals that colonize other geographic areas where reproductive rates of forest birds are extremely low. Research in the Midwest has shown that such “source-sink” dynamics result primarily from the effects of high levels of cowbird parasitism and nest predation in areas where forest fragments fall below a size of 10,000 acres or where forest coverage across broad landscapes falls below 70% (Fitzgerald and Pashley 2000). Therefore, since the East Fredericktown analysis area is 80% forested and contains well over 10,000 acre blocks of forested land, it is assumed that high levels of cowbird parasitism and nest predation are not occurring across the analysis area. However, some cowbird parasitism and nest predation may be occurring in some locally fragmented areas where forest land is interspersed with agricultural lands, wide road corridors, or other non-forested areas.

Currently, 33 species of birds have been identified as Partners in Flight priority species for the Ozark/Ouachita physiographic area (Fitzgerald and Pashley 2000). These priority species represent birds that deserve special conservation efforts that will ensure their viability. Of these 33 species, 28 are likely to occur and breed within the East Fredericktown analysis area (refer to Table WL-12).

Table WL-12. Partners in Flight priority species for the Ozark/Ouachita physiographic area that are likely or known to occur within the East Fredericktown analysis area (species in bold were documented in the analysis area during 2003 field surveys).

Swainson's warbler	Prothonotary warbler	**Ovenbird**	**Summer tanager**
Cerulean warbler	**Louisiana waterthrush**	**Pileated woodpecker**	**Wood thrush**
Kentucky warbler	Field sparrow	**Carolina chickadee**	Red-headed woodpecker
Worm-eating warbler	Orchard oriole	Chuck-will's widow	Loggerhead shrike
Prairie warbler	Northern bobwhite	**Blue-winged warbler**	Purple finch
Whip-poor-will	Brown thrasher	**Yellow-billed cuckoo**	Rusty blackbird
Acadian flycatcher	Great-crested flycatcher	**Yellow-throated warbler**	Bewick's wren

Field surveys also revealed the presence of many more bird species in the analysis area, several of which are neotropical migrants. These additional species were golden-crowned kinglet, red-shouldered hawk, downy woodpecker, snow geese, red-tailed hawk, white-breasted nuthatch, eastern tufted titmouse, pine warbler, brown creeper, black and white warbler, yellow-rumped warbler, red-bellied woodpecker, dark-eyed junco, wild turkey, blue-gray gnatcatcher, yellow-bellied sapsucker, broadwing hawk, green heron, northern parula, American goldfinch, hooded warbler, red-eyed vireo, scarlet tanager, summer tanager, white-throated sparrow, northern cardinal, yellow-throated vireo, white-eyed vireo, indigo bunting, chestnut-sided warbler, worm-eating warbler, eastern towhee, eastern wood pewee, blackburnian warbler, ruby-throated hummingbird, winter wren, ruby-crowned kinglet, northern flicker and turkey vulture.

WILDLIFE – DIRECT, INDIRECT, AND CUMULATIVE EFFECTS BY ALTERNATIVE

Alternative 1

Forest Plan Habitat Objectives for Wildlife

4.1 Management Prescription Direct and Indirect Effects: Alternative 1 proposes several activities within the 4.1 MP of the analysis area that would have both direct and indirect effects upon the eight wildlife habitat objectives that have been identified in the Forest Plan.

Under Alternative 1, 850 acres would be mechanically treated using "heavy mechanical" methods that would mimic a seedtree cut. Because these methods would reduce the canopy cover to less than 30% within the treated stands, these acres would be considered within the 0 to 9 year age class. Therefore, the amount of woodland habitat in the 0 to 9 year age class in the 4.1 MP within the analysis area would increase by 850 acres, or 2.4%, under this alternative. Immediately following implementation of Alternative 1, the percentage of habitat that meets this objective in the 4.1 MP of the analysis area would be 5.1%. Since the existing levels of habitat that meet this objective within the Oak-Pine Hills and Plains LTAs are below the desired future conditions (DFC), an increase in this habitat component is desired to provide habitat for wildlife species that prefer young forest conditions and scrub-shrub habitat. Other activities proposed in Alternative 1, such as moderate mechanical treatment of forest stands and prescribed burning, would also contribute habitat for these species, but are not included in calculations for this objective because

they would not likely result in a canopy cover of less than 30%.

Woodland habitat in the old growth condition would decrease in the short term under this alternative, but increase over the long term. Currently, 726 acres within the 4.1 MP of the analysis area appear to meet some old growth criteria. Under Alternative 1, 152 acres of this would be treated using mechanical treatments (upon field review, it was determined that these 152 acres did not technically meet the definition for old growth, as it had been defined in the Forest Plan). The treatment of these 152 acres would reduce the number of acres that currently meet old growth criteria from 726 acres (4.4%) to 574 acres (3.4%). The remaining 574 acres would be retained under Alternative 1, 303 acres of which would become designated as old growth under Alternative 1 and, therefore, be retained indefinitely. An additional 1,390 acres would also be designated for future old growth habitat under this alternative. These 1,390 acres do not currently meet old growth criteria, but would be allowed to reach old growth conditions over time. Therefore, the combined 1,390 acres of designated old growth, combined with the 303 acres of existing old growth to be designated, would result in 1,693 acres of designated existing or future old growth (Figure WL-1). This would increase the percentage of woodland habitat in the old growth condition from the existing 4.4% to 10.2% in the 4.1 MP of the analysis area. Since the existing levels of habitat that meet this objective within the Oak-Pine Hills and Plains LTAs are below the desired future conditions (DFC), an increase in this habitat component is desired to provide habitat for wildlife species that prefer old growth conditions. Most of the designated old growth would be located in riparian areas and would be interconnected. In the future, this would provide more contiguous and larger blocks of old growth habitat within the analysis area than currently exists. This would improve habitat conditions for species that require unfragmented tracts of mature and old growth forest. Acres not designated may not be retained for future old growth.

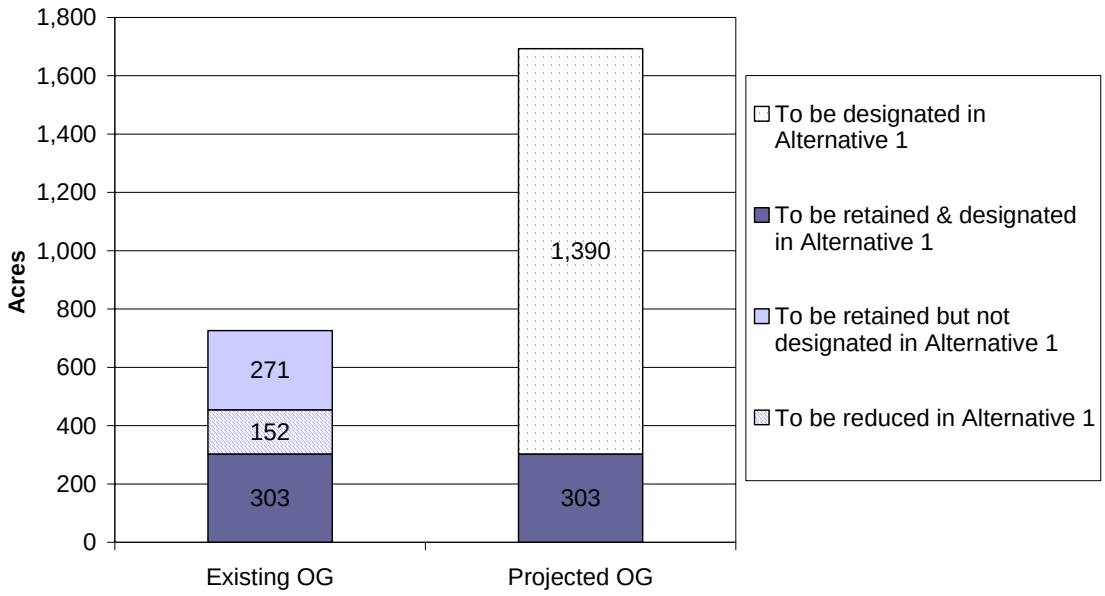

Figure WL-1. Existing and projected old growth (OG) levels within the 4.1 MP of the analysis area under Alternative 1.

The amount of woodland habitat in the oak and oak-pine types over 50 years of age would decrease slightly under Alternative 1. This habitat objective was established as a measure of hard mast availability for wildlife and assumes that 77 pounds per acre of mast is produced in stands have an average DBH greater than 8 inches and a canopy cover greater than 44%. To measure the changes in this habitat objective under Alternative 1, it has been assumed that only heavy mechanical treatments proposed would result in a canopy cover less than 44%. Of the 850 acres proposed for heavy mechanical treatment, 834 acres currently meet this habitat objective. Therefore, current levels of this habitat objective would be reduced under Alternative 1 by 834 acres, or 5%. Immediately following implementation of Alternative 1, the percentage of habitat that meets this objective in the 4.1 MP of the analysis area would be approximately 57%. Since the existing levels of habitat that meet this objective within the Oak-Pine Hills and Plains LTAs are above the desired future conditions (DFC), a decrease in this habitat component is desired. The levels of this habitat would still be well above the minimum viable levels (MVP) of 25% for species that require this habitat condition, and wildlife species dependent upon hard mast would still be well provided for under Alternative 1.

All of the mechanical treatments proposed in Alternative 1 would be expected to result in forest stands with less than 80% canopy cover. Currently, within the 4.1MP of the analysis area, 12,325 acres of woodland habitat in pole and sawtimber size classes has > 80% canopy cover. Under Alternative 1, 4,329 acres of this would be mechanically treated, thereby reducing the amount of habitat that meets this objective by 26%. Immediately following implementation of Alternative 1, the percentage of habitat that meets this objective in the 4.1 MP of the analysis area would be approximately 48%. Since the existing levels of habitat that meet this objective within the Oak-Pine Hills and Plains LTAs are above the desired future conditions (DFC), a decrease in this habitat component is desired. The levels of this habitat would still be well above the minimum viable levels (MVP) of 20% for species that require this habitat condition and wildlife species dependent upon closed canopy forest would still be well provided for under Alternative 1.

The amount of woodland habitat that has at least a 20 to 30% forb, grass, or shrub ground cover would increase dramatically under Alternative 1, from the current level of 8.5% to 44.1%, within the 4.1 MP of the analysis area. This dramatic increase is directly attributed to activities that would occur under Alternative 1 that would create more open forest stands and result in more sunlight reaching the forest floor, which generally creates a heavier grass, forb, and shrub component. Activities proposed under this alternative that are likely to achieve this condition include heavy and moderate mechanical treatments, prescribed burning, and savannah restoration. These activities would create 7,041 acres of habitat that meets this objective, as well as maintain an existing 307 acres already within this condition. However, a slight loss of habitat that meets this objective would also occur under Alternative 1, since 198 acres proposed for old growth designation currently meets this objective. If allowed to meet old growth conditions, it is likely that the existing shrub, grass and forb component within these 198 acres would gradually decrease as the stands age. Nevertheless, even with this slight loss, habitat for species that require a grass, shrub or forb understory would be readily available under Alternative 1, given the projected levels.

Similarly, the amount of woodland habitat over 50 years of age with a dense understory would also increase due to activities that would create more open forest stands. All of the mechanical treatments proposed in Alternative 1 would be expected to contribute to a dense understory. Currently, 1,576 acres meet this habitat objective. Under Alternative 1, 298 acres of this would be maintained and an additional 3,008 acres would be created by mechanical treatments. There would also be a slight loss of 207 acres that currently meet this objective under Alternative 1, since these acres would become designated old growth and therefore, over time, become more closed canopy

and likely to lose their shrub component. Overall, however, Alternative 1 would be expected to increase levels for this habitat objective from the existing 9.5% to 20% within the 4.1 MP of the analysis area. This increase is desirable, given that the existing levels for this habitat objective within the Oak-Pine Hills and Plains LTAs are below the minimum required Forest-wide. This increase within the analysis area would benefit many species that prefer a dense shrub understory but still utilize a mature forest overstory.

For this analysis, the habitat objective for open and semi-open lands is considered represented by forest stands that are classified as being in a permanently non-forested (brush or grassland) or savannah condition. Currently, 284 acres within the 4.1MP of the analysis area meet this objective. Alternative 1 proposes activities (prescribed burning and savannah restoration) that would maintain the open characteristics on 81 acres of this. For the remaining 203 acres, no activities would occur that would maintain these open conditions, therefore, over time, there would be expected to be a decrease in the amount of habitat that meets this objective within the analysis area. With implementation of Alternative 1, the projected levels for this habitat objective are expected to decrease from the current 1.7% to 0.5%. This would result in reduced habitat for species that require open lands, particularly grass-dominated lands. However, many of the wildlife species that require these open and semi-open habitats would also utilize forest stands in the 0 to 9 year age class, as well as forest stands with a low canopy cover and grassy or shrubby understory, and levels of those types of habitats are expected to increase under this alternative.

The availability of upland water sources within the 4.1MP of the analysis area would increase substantially under Alternative 1. This alternative would allow for maintenance of 4 existing water sources and creation of 30 additional water sources. Those water sources not maintained under this alternative (16 in total) would be allowed to gradually fill with aquatic vegetation and become more marsh-like, which also provides habitat for many wildlife species. However, because these 16 water sources would not be maintained under Alternative 1, they are included in the projected levels for future water within the analysis area. With a net total of 34 water sources to be maintained or created within the 4.1 MP of the analysis area, the number of water sources per square mile is projected to increase from its current 0.8 per square mile to 1.3 per square mile. This would be within the Forest Plan's desired future condition levels of 1 to 2 water sources per square mile for the 4.1 MP, and would provide habitat for many wildlife species that are dependent upon readily available water sources during part or all of their life cycle.

4.1 Management Prescription Cumulative Effects: The cumulative effects of implementing Alternative 1 are based upon knowledge of the current conditions, past activities, other present activities being considered, and reasonably foreseeable activities in the analysis area. Also considered are the current and foreseeable conditions of the National Forest at a landscape scale, as well as adjacent private lands.

The foreseeable cumulative effect that implementation of Alternative 1 would have upon the eight wildlife habitat objectives identified for the 4.1 MP would be an overall increase in early successional forest and diverse forest understory represented by grasses, forbs and shrubs. Habitat objectives that focus on mature forest stands with a dense forest canopy would be expected to slightly decrease throughout the analysis area and within the 4.1 MP with implementation of Alternative 1. However, this is not expected to have a negative cumulative effect upon wildlife species that require dense forest canopy, since the majority of forested private lands within the analysis area and across the Ozarks are mature forests that meet this habitat condition, as well as most of the National Forest both within and outside the analysis area.

8.1 Management Prescription Direct and Indirect Effects: Alternative 1 proposes prescribed burning approximately 368 acres in "Salamander Hollow." No other activities are

proposed within the 8.1MP under this alternative. While prescribed burning would not necessarily improve the desired, shaded, closed canopy conditions of "Salamander Hollow," it also is not anticipated to alter the overall character or stand conditions of "Salamander Hollow" or any other 8.1MP areas. This is because prescribed burning within this MP would occur at relatively low intensities, especially since much of "Salamander Hollow" is shaded and damp and not likely to support a high intensity fire. Some wildlife species that prefer deep leaf litter and damp, shaded conditions, particularly some amphibians, reptiles and ground-nesting birds, may be negatively impacted by this prescribed burning, but this impact is not expected to be long-term or reduce viability of any wildlife species.

There are no activities proposed within the remaining 8.1 MP areas of the analysis area. No activities are proposed in the "Bidwell Creek glade" or "Wash Creek fen" under Alternative 1. These areas may be indirectly affected by allowing them to continue to mature without any stand disturbing activities. As a result, these stands would gradually become more closed-canopy and favor shade-tolerant species. For "Bidwell Creek glade," this would likely be an indirect negative effect, because glades are historically maintained by burning and support many rare species that require open, sunny conditions. As the forest matures around the glade, these species could gradually become suppressed and out-competed by encroaching vegetation and more shade-tolerant species. "Wash Creek fen" would likely remain unaffected, although it, too, would benefit from prescribed burning.

8.1 Management Prescription Cumulative Effects: There are no foreseeable cumulative effects upon this MP within the analysis area. Existing levels of National Forest lands in 8.1MP would not change under this alternative. Past, present, and foreseeable activities on private lands in the analysis area and elsewhere are not expected to change the current levels or conditions of 8.1MP.

Road Effects upon Wildlife

Under Alternative 1, there would be no change in the existing road density on National Forest within the project area because no new roads would be constructed as part of this alternative and no existing roads would be decommissioned. Currently, the road density within the project area is approximately 2.7 mi/sq. mi. This road density estimate includes all State, County, Private, and USFS System and Non-System roads that have been identified within the project area.

Based upon research by King and DeGraaf (2002), a road density of 2.7 mi/sq. mi. is at or below the threshold at which significant negative effects on forest birds generally appear. With a road density of 1.2 miles of USFS system road/sq. mile of National Forest, the road density for the National Forest in the project area is also well below the Forest Plan's maximum density limit (FLMP IV-131). This indicates that the road density is not at a level that would jeopardize any wildlife species' continued viability within the project area.

In Alternative 1, approximately 17,135 acres would be considered within the "road effect zone." Some wildlife species would be expected to avoid this "road effect zone" due to the likelihood that road noise, human activities, and edge effects would be greater within this zone than outside it. In particular, activities that may impact game species, such as hunting, trapping, and poaching, would be expected to be higher within this zone than outside it because these areas are more easily accessed by people. Other activities, such as gathering plant materials for medicinal or commercial uses, and general wildlife observation, would also be expected to be higher within these zones. These zones would also be most likely to harbor or introduce non-native plant species, many of which are considered noxious weeds.

The contribution that roads may be making within the project area to overall fragmentation

of interior forest habitat would not change from the existing situation under Alternative 1. Because no roads would be decommissioned under this alternative, there would be no reduction in edge effect that may be occurring as a result of existing roads in the project area. Conversely, no new roads would be constructed under this alternative; therefore, there would be no increase in fragmentation or edge effect as a result of new roads on National Forest.

Currently, there are approximately 5 blocks of National Forest within the project area that are > 500 acres and are not crossed by any known roads (i.e., "road-free"). In Alternative 1, this number would not change. However, within 1 of these blocks, some of this mature forest interior habitat would be temporarily fragmented by some of the temporary roads and timber regeneration activities proposed in this alternative. Areas that do not have permanent roads and do not have timber regeneration activities occurring within them would offer the best habitat for species that require large tracts of mature forest. For species that are more tolerant of habitat fragmentation, but tend to avoid areas of human activity, all of the "road-free" areas would offer them the best suitable habitat on National Forest in the project area, regardless of whether or not timber regeneration activities occurred in these blocks.

No unique communities or rare or listed-species would be expected to be further impacted directly by roads under Alternative 1. Although some unique plant communities, especially glades and seeps, occur immediately adjacent to some of the roads within the project area, effects to these unique communities as a result of roads would not be expected to change from the existing situation because this alternative does not propose any changes to the existing road conditions, locations, or maintenance. There are no federally threatened, endangered, or candidate species known to occur within any of the "road effect zones" or within the influence of any roads in the project area.

Table WL-13. Summary of Road Effects Indices for Alternative 1

Units of Measure		Potential Effects upon Wildlife
Road Density of all roads in project area	2.7 mi./sq. mi.	As road density increases, negative impacts upon wildlife such as habitat disturbance, road kill, and changes in their population distributions would likely also increase.
Acres within "Road Effect Zones"	17,135	These zones represent areas in which wildlife species would be most vulnerable to human activities and habitat conditions created by the roads.
No. of "road-free" areas > 500 acres on National Forest within project area	5	These areas would offer the best blocks of habitat on National Forest in the project area for species that tend to avoid roads and human use areas.
No. of "road-free" areas > 500 acres on National Forest within project area that would not be affected by timber regeneration activities	4	These areas represent the best blocks of habitat on National Forest in the project area for species that require large tracts of mature, forest interior habitat.

Management Indicator Species

Direct and Indirect Effects:

Pileated Woodpecker: The pileated woodpecker is considered an indicator species for wildlife that require large tracts of mature forest. This species is also a cavity nester and requires large snags within a forested landscape.

Activities proposed in Alternative 1 would have a direct effect upon habitat for pileated woodpeckers and, therefore, may indirectly affect the woodpeckers themselves. Habitat objectives that benefit pileated woodpeckers would be altered by Alternative 1. In the short term, habitat in the old growth condition and woodland habitat greater than 50 years of age and/or with 80% canopy cover would be reduced by Alternative 1. This reduction could negatively impact pileated woodpeckers by reducing the availability of older aged stands with large diameter cavity trees in the analysis area. However, proposed activities in Alternative 1 would make an effort to retain all large diameter (> 26" dbh) trees and trees that are hollow, so this impact would be minimized. In the long term, the amount of old growth within the analysis area would be expected to increase. This would have a beneficial effect upon pileated woodpeckers. Overall, in the short term, Alternative 1 would be expected to reduce habitat for pileated woodpeckers; however, over the long term (50 years), habitat for pileated woodpeckers is expected to be restored as stands mature. Mature stand conditions would still predominate within the analysis area, even if Alternative 1 is implemented.

Ovenbird: The effects of Alternative 1 upon ovenbird populations and their habitats would be similar to the effects discussed for pileated woodpecker. However, unlike pileated woodpeckers, ovenbirds require a dense understory and do not nest in cavities, but rather on the ground.

Ovenbirds are often associated with mature forest stands. Alternative 1 would reduce the amount of woodland habitat over 50 years old and, in the short-term, the amount of old growth within the analysis area. This could have an indirect negative effect upon some ovenbirds that currently occupy these stands. Prescribed burning proposed may also impact some nesting ovenbirds, but this would be a short term impact and ovenbirds may re-nest following the burn. Alternative 1 would also improve some habitat conditions for ovenbirds by increasing the amount of shrub and grass/forb habitat within the analysis area, particularly in woodland sawtimber stands. Overall, however, because the ovenbird is considered a species of mature forests, habitat for this species would be reduced by Alternative 1 since this alternative would temporarily reduce the availability of mature stands within the analysis area. This reduction, however, may be somewhat offset by activities that increase the shrub component of stands under this alternative, and mature stand conditions would still predominate within the analysis area, even if Alternative 1 is implemented.

Wild Turkey: The wild turkey can be found in a variety of habitats and utilizes different habitats during different phases of its life. For the most part, this is a species considered dependent upon mature oak-hickory forest, primarily because it feeds heavily on acorns and hard mast. However, it is just as frequently found on edges of forest and in semi-open conditions, especially during breeding season or when feeding young.

Alternative 1would reduce the availability of mature, mast producing stands within the analysis area. This could reduce the availability of existing food sources within the analysis area for wild turkeys. However, these stands would also likely have an increase in shrubs and grasses and forbs following treatment, so the loss of hard mast within the stands could be replaced with a gain in soft mast, seeds, and herbs in the understory. The wild turkey would also be benefited by the prescribed burning proposed in Alternative 1, which also would likely increase the grass and shrub layer. Springtime prescribed burning could have a negative impact upon nesting wild turkeys; however, this effect would be short-term, and turkeys may renest following the

burn. An increase in upland water availability, resulting from construction of additional water holes under Alternative 1, would also improve habitat for the wild turkey. Overall, while Alternative 1 may reduce the availability of mature mast producing stands, the habitat improvements that would occur under Alternative 1 would likely outweigh the potential negative effects resulting from loss of mature stands, and it is assumed that wild turkeys would be benefited under this alternative. Mature stand conditions would still predominate within the analysis area, even if Alternative 1 is implemented.

White-tailed deer: The general habitat requirements for the white-tailed deer are very similar to that of the wild turkey. As a result, effects of Alternative 1 upon deer are expected to be similar to those described for wild turkey.

Raccoon: The raccoon is found in a variety of forested landscapes. This species is less dependent upon the size and distribution of forest, than it is upon the presence of large diameter den trees. Raccoons are typically found in areas near mature oak forests. Raccoons require large diameter trees that can be utilized as dens. They also prefer some shrub understory, since a large part of the raccoon's diet is comprised of berries and fruits that come from shrubs. Raccoons are also frequently associated with water and would benefit from a good distribution of water sources across the landscape.

Because the availability of large den trees seems to be a common limiting factor for raccoons, activities that reduce the availability of these trees within the analysis area could have a negative impact upon raccoons. Reduction of mature woodland habitat may have an indirect effect upon raccoons because the availability of large hollow trees may be reduced. However, proposed activities in Alternative 1 would make an effort to retain all large diameter (> 26" dbh) trees and trees that are hollow, so this impact would be minimized. Raccoons would likely benefit from the increased shrub and forb understory that would result from activities proposed in Alternative 1, since this would provide additional cover and food for raccoons within the analysis area. The increase in upland water sources within the analysis area that would occur under Alternative 1 would also improve habitat for raccoons. Therefore, overall, Alternative 1 would be expected to improve habitat for raccoons within the analysis area.

Wood thrush: The general habitat requirements for the wood thrush are very similar to that of the ovenbird. The biggest difference between the two would be that wood thrushes seem to prefer somewhat damper, heavily shaded environments, often along ravines. However, because the habitat requirements for wood thrush are similar to that of ovenbirds, the effects of Alternative 1 upon the wood thrush are expected to be similar to those described for the ovenbird.

Ruffed grouse: A key habitat requirement for the ruffed grouse is the presence of forest stands that contain a high stem density. This high stem density can be provided in many forms, but is most often provided by very early successional forest habitat. It may also be found occasionally in infrequently burned or mowed fields, power line corridors, or roadsides. This high stem density provides the ruffed grouse with both cover and often food, since this type of habitat often produces high yields of soft mast, such as blackberries, sumac berries, seeds, etc.

Activities proposed in Alternative 1 are expected to improve habitat conditions for the ruffed grouse because several of these activities would result in a higher stem density for several forest stands. Prescribed burning may negatively impact nesting ruffed grouse; however, grouse may renest, and prescribed burning would likely increase the understory stem density of some stands. The construction of additional upland water sources within the

analysis area would also improve habitat conditions for ruffed grouse.

Bobcat: Bobcats are very secretive creatures, but research indicates that they typically are found in large-scale, forested environments that have a mixture of scrub-shrub habitats and openings interspersed with more mature forest. Bobcats feed heavily upon small mammals, particularly rabbits, and would be expected to prefer a forested landscape that contains good amounts of shrubby habitat for rabbits. Bobcats also prefer shrub habitat for shelter and bedding areas.

Given this, the bobcat's habitat is probably best represented by the habitat objective of woodland habitat in the oak type over 50 years of age with a dense understory. This objective would provide bobcats with a mature forest setting, in which a dense shrub layer exists to provide shelter and food. In Alternative 1, the amount of habitat that meets this objective is expected to increase, and therefore, bobcats are expected to be benefited by this alternative.

Indigo bunting: Like the ruffed grouse, the indigo bunting is also a species that prefers scrub-shrub habitat with a high stem density. However, unlike the ruffed grouse, the indigo bunting can often be found in very small pockets of this habitat and is often found in parks, backyards, and hedgerows.

Because of its similar habitat requirements to the ruffed grouse, the effects of Alternative 1 upon the indigo bunting are similar to those described for ruffed grouse.

Cumulative Effects

Pileated woodpecker, ruffed grouse, indigo bunting and wild turkey are showing population declines either state-wide or on the Ozark-Ouachita Plateau. The contribution of Alternative 1 to these declines would be considered negligible, given the size of the analysis area to the overall Plateau. Alternative 1 proposes several activities that would likely improve habitat conditions for wild turkey, white-tailed deer, raccoon, ruffed grouse, bobcat, and indigo bunting. This may indirectly result in slight increases of populations of these species within the analysis area and would contribute to a beneficial cumulative effect for these species.

Alternative 1 is expected to temporarily reduce some habitat for the pileated woodpecker, ovenbird, and wood thrush within the analysis area; however, not to the extent that population levels of these species would be expected to decline significantly within the analysis area or throughout their ranges. Although the pileated woodpecker is showing declines state-wide, on the Ozark-Ouachita Plateau, populations seem to be increasing, and although Alternative 1 may not contribute to this increase, activities proposed would not jeopardize the continued viability or abundance of this species. Ovenbird and wood thrush are showing population increases throughout the state and on the Ozark-Ouachita plateau. The majority of the analysis area, including private lands, would continue to offer suitable habitat for these three species if Alternative 1 is implemented, and no adverse cumulative effects upon these species' population levels are anticipated.

Federally Threatened and Endangered Species

The effects of Alternative 1 upon federally threatened, endangered, and proposed species of the Mark Twain National Forest have been disclosed in a Biological Evaluation/Assessment (BAE) and a BAE supplement that were prepared specifically for this analysis. The BAE's can be found in Appendix A.

The BAE's determined that Alternative 1 would have "no effects" upon five species and "is not likely to adversely affect" six species (Table WL-14). The BAE's determined that Alternative 1 "may adversely affect" the Indiana bat, but none of these effects would be beyond those previously evaluated at a programmatic level on the Mark Twain National Forest with US Fish and Wildlife Service (US Forest Service 1998; US Fish and

Wildlife Service 1999). These effects include all direct, indirect, and foreseeable cumulative effects. The rationale and discussions for these determinations of effects for each species can be found in the BAE.

Table WL-14. Summary of effects of Alternative 1 upon federally-listed species.

Species	Determination of Effect	Species	Determination of Effect
Topeka shiner	No effects	Running buffalo clover	Is not likely to adversely affect
Tumbling creek cavesnail	No effects	Mead's milkweed	Is not likely to adversely affect
Gray bat	Is not likely to adversely affect	Pink mucket pearlymussel	No effects
Indiana bat	May adversely affect	Ozark hellbender	No effects
Bald eagle	Is not likely to adversely affect	Scaleshell mussel	No effects
Hine's emerald dragonfly	Is not likely to adversely affect	Curtis' pearlymussel	Is not likely to adversely affect

Regional Forester's Sensitive Species and other Species of Concern

The effects of Alternative 1 upon Regional Forester's Sensitive Species and other Species of Concern of the Mark Twain National Forest have been disclosed in a Biological Evaluation/Assessment (BAE) that was prepared specifically for this analysis. The BAE can be found in Appendix A.

The BAE determined that Alternative 1 would have "no impact" upon any RFSS or Species of Concern that are primarily restricted to streams/rivers, grasslands, caves, or wetlands. The BAE determined that Alternative 1 "may impact individuals or habitat but would not likely contribute to a trend towards federal listing or loss of population viability" for any RFSS or Species of Concern that are primarily restricted to riparian areas, forested habitats and slopes, glades, seeps/fens, and bluffs. The rationale and discussion for these determinations can be found in the BAE.

Specialized Habitats

Springs, seeps & fens: The effects of Alternative 1 upon seeps and fens and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Seep/Fen-associated species".

Riparian areas: The effects of Alternative 1 upon riparian areas and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Riparian-associated species".

Bottomland hardwood forests: The direct and indirect effects of Alternative 1 upon bottomland hardwood forest would be similar to those described for riparian areas.

Glades: The effects of Alternative 1 upon glades and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "glade-associated species".

Shortleaf pine forest: Alternative 1 would implement several stand treatments that are intended to regenerate shortleaf pine within the analysis area. While some mature pine stands may

be lost in the short term to these activities, over the long term, these activities would help to sustain pine within the analysis area. Without these stand regenerating activities, many existing pine stands would likely become more hardwood dominated. Because Alternative 1 proposes mechanical treatment of stands without removal of wood products, the potential for natural pine regeneration within these stands would be lower than if these materials were removed, because tree tops and stems would cover a large percentage of the forest floor in these stands following treatment, impeding pine regeneration. However, some pine regeneration would still be expected. Prescribed burning proposed under Alternative 1 would also improve conditions for shortleaf pine by creating more open stand conditions and reducing leaf litter, which would encourage natural pine regeneration.

Fishless ponds and temporary pools: Alternative 1 would increase the number of fishless ponds and temporary pools within the analysis area. Under this alternative, fishless ponds and temporary pools would be developed within the analysis area, and some existing ponds would be maintained. This would improve habitat conditions for species that require this specialized habitat.

Birds (emphasizing Neotropical Migrants)

Direct and Indirect Effects: Alternative 1 would implement several activities that may have a direct effect upon individual birds. Many stand treatments proposed involve tree felling, and this could destroy active bird nests and disrupt nesting or breeding behavior. Prescribed burning during the nesting season may also have a similar effect. However, this would be a short term effect and only involve some individual birds. Populations of these birds within the analysis area would not be expected to change as a result of these disruptions. Many birds would successfully renest following loss of a nest, depending upon various conditions.

Indirectly, this alternative would benefit birds that prefer early successional forest stands because it increases the availability of young forest and scrub-shrub habitat within the analysis area. These early successional forest stands would be surrounded by interconnected mature forest and not result in complete isolation of any mature forest stand from other mature forest stands. None of the activities proposed would result in conversion of any forested lands to non-forested lands. Where edge habitat is created by activities proposed in the alternative, the potential for increased cowbird parasitism and nest predation does increase. Given that most of the analysis area is forested, cowbird parasitism levels are not expected to be high within the analysis area. Some individual birds that occupy closed-canopy forests may be temporarily displaced by some activities proposed in Alternative 1. However, even with implementation of Alternative 1, population levels of these species would be expected to remain near the current levels within the analysis area since most of the analysis area would continue to offer mature closed-canopy forest. Habitat for birds that occupy early successional forest and openings within the forest would increase under this alternative but continue to be somewhat limited within the analysis area.

Table WL-15. Anticipated effects of Alternative 1 upon Partners in Flight priority species for the Ozark/Ouachita physiographic area that are likely to occur within the analysis area.

Species	Preferred Habitat	Effect of Alternative 1
Kentucky warbler, Prairie warbler, Whip-poor-will, Field sparrow, Orchard oriole, Northern bobwhite, Brown thrasher, Chuck-will's widow, Blue-winged warbler, Loggerhead shrike, , Bewick's wren	Forest edge, young sapling/poletimber forest, scrub-shrub, fields, or openlands, often intermixed with mature forest.	Would improve conditions for these species by increasing availability of forest edge, young forest and scrub-shrub habitat within the analysis area.

Species	Preferred Habitat	Effect of Alternative 1
Swainson' warbler, Cerulean warbler, Acadian flycatcher, Prothonotary warbler, Louisiana waterthrush, Yellow-throated warbler, Rusty blackbird	Mature riparian forests, often with some midstory and shrub development	Would maintain existing mature riparian forest habitat and may increase shrub component within some riparian areas.
Worm-eating warbler, Great-crested flycatcher, Ovenbird, Pileated woodpecker, Carolina chickadee, Yellow-billed cuckoo, Yellow-throated warbler, Summer tanager, Wood thrush, Red-headed woodpecker, Purple finch	Mature forest with semi-open canopies and relatively open midstory and some shrub development	Would reduce some existing mature forest habitat but overall, habitat for these species would be maintained within the analysis areas in stands not proposed for treatments. Some stand treatments would improve conditions for species that prefer semi-open canopies and some shrub understory.

Cumulative Effects: Across the Ozark/Ouachita physiographic area, many species of birds that are considered priority species for conservation (identified in Table WL-5) are considered species that prefer or are favored by open woods or scrub-shrub or grassland habitat. Declines in several of these birds are being observed across the physiographic area.
Many would benefit especially from the prescribed burning and other activities proposed in Alternative 1 that would maintain a semi-open canopy of mature trees, with an understory of shrubs and grasses. Therefore, this alternative would contribute to a positive cumulative effect upon these species. For species that prefer open, mature forest conditions, Alternative 1 would not necessarily improve habitat availability for these birds, but also would not likely contribute to a negative cumulative negative effect upon these species, since all of the activities proposed would maintain a forested condition over the long term.

Alternative 2

Forest Plan Habitat Objectives for Wildlife

4.1 Management Prescription Direct and Indirect Effects: Alternative 2 proposes several activities within the 4.1 MP of the analysis area that would have both direct and indirect effects upon the eight wildlife habitat objectives that have been identified in the Forest Plan.

Of the eight wildlife habitat objectives considered, five would be affected by Alternative 2 in the same manner as has been described for Alternative 1. These five habitat objectives are

- Woodland habitat in the 0 to 9 year age class
- Woodland habitat in the old growth condition
- Woodland habitat in the oak and oak-pine types over 50 years of age
- Open and semi-open habitat
- Permanent water sources

Therefore, effects upon wildlife species that utilize habitats reflected by these five objectives would be the same under Alternative 2 as has been described in Alternative 1. The three remaining habitat objectives would be affected differently in Alternative 2, than in Alternative 1.

Woodland habitat in pole and sawtimber size classes with crown closure over 80% would be decreased from the existing 74% to approximately 46.6% within the 4.1MP of the analysis area. This is a reflection of the loss of 80% canopy cover as a result of even and uneven-aged management treatments, as well as crop tree release and overstory removal. Since the existing levels of habitat that meet this objective within the Oak-Pine Hills and Plains LTAs are above the desired future conditions (DFC), a decrease in this habitat component is desired. The levels of this habitat would still be well above the minimum viable levels (MVP) of 20% for species that require this habitat condition and wildlife species dependent upon closed canopy forest would still be well provided for under Alternative 2.

The amount of woodland habitat that has at least a 20 to 30% forb, grass, or shrub ground cover would increase dramatically under Alternative 2, from the current level of 8.5% to 44.2%, within the

4.1 MP of the analysis area. This dramatic increase is directly attributed to activities that would occur under Alternative 2 that would create more open forest stands and result in more sunlight reaching the forest floor, which generally creates a heavier grass, forb, and shrub component. Activities proposed under this alternative that are likely to achieve this condition include even and uneven-aged management treatments, prescribed burning, and glade and savannah restoration. These activities would create 7,054 acres of habitat that meets this objective, as well as maintain an existing 311 acres already within this condition. However, a slight loss of habitat that meets this objective would also occur under Alternative 2. Currently, 198 acres meets this objective but is proposed for old growth designation in this alternative. If allowed to meet old growth conditions, it is likely that the existing shrub, grass and forb component within these stands would gradually decrease as the stands age. Nevertheless, even with this slight loss, habitat for species that require a grass, shrub or forb understory would be readily available under Alternative 2, given the projected levels.

Similarly, the amount of woodland habitat over 50 years of age with a dense understory would also increase due to activities that would create more open forest stands. All of the even and uneven-aged management treatments as well as savannah and glade restoration proposed in Alternative 2 would be expected to contribute to a dense understory by opening the forest canopy. Currently, 1, 576 acres meet this habitat objective. Under Alternative 2, 457 acres of this would be maintained and an additional 3,008 acres would be created by proposed activities. There would also be a slight loss of 207 acres that currently meet this objective under Alternative 2, since these acres would become designated old growth, and therefore, over time, become more closed canopy and likely to lose their shrub component. Overall, however, under Alternative 2, levels for this habitat objective would be expected to increase from the existing 9.5% to 20.8% within the 4.1 MP of the analysis area. This increase is desirable, given that the existing levels for this habitat objective within the Oak-Pine Hills and Plains LTAs are below the minimum required Forest-wide. This increase within the analysis area would benefit many species that prefer a dense shrub understory but still utilize a mature forest overstory.

4.1 Management Prescription Cumulative Effects: The cumulative effects of implementing Alternative 2 are based upon knowledge of the current conditions, past activities, other present activities being considered, and reasonable foreseeable activities in the analysis area. Also considered are the current and foreseeable conditions of the National Forest at a landscape scale, as well as adjacent private lands.

The foreseeable cumulative effect that implementation of Alternative 2 would have upon the eight wildlife habitat objectives identified for the 4.1 MP would be a temporary, overall increase in early successional forest and diverse forest understory represented by grasses, forbs and shrubs. Habitat objectives that focus on mature forest stands with a dense forest canopy would be expected to slightly decrease throughout the analysis area and within the 4.1 MP with implementation of Alternative 2. However, this is not expected to have a negative cumulative effect upon wildlife species that require mature, closed canopy forests, since the majority of forested private lands within the analysis area and across the Ozarks, as well as most of the National Forest both within and outside the analysis area, offer mature forest stands with a dense forest canopy condition.

8.1 Management Prescription Direct and Indirect Effects: Alternative 2 proposes prescribed burning approximately 368 acres in "Salamander Hollow" and glade restoration activities within "Bidwell Creek glade." No other activities are proposed within the 8.1MP under this alternative. While prescribed burning would not necessarily improve the desired, shaded, closed canopy conditions of "Salamander Hollow," it also is not anticipated to alter the overall character or stand conditions of "Salamander Hollow" or any

other 8.1MP areas. This is because prescribed burning within this MP would occur at relatively low intensities, especially since much of "Salamander Hollow" is shaded and damp and not likely to support a high intensity fire. Some wildlife species that prefer deep leaf litter and damp, shaded conditions, particularly some amphibians, reptiles and ground-nesting birds, may be negatively impacted by this prescribed burning, but this impact is not expected to be long-term or reduce viability of any wildlife species.

Glade restoration activities within the "Bidwell Creek glade" would likely improve habitat for species that prefer open, glade environments, especially many reptiles. These glade restoration activities would remove encroaching cedars and other non-desirable woody species from the glade. This action would maintain the glade's historical open, sunny characteristics.

"Wash Creek fen" would likely remain unaffected by Alternative 2.

8.1 Management Prescription Cumulative Effects: There are no foreseeable cumulative effects upon this MP within the analysis area. Existing levels of National Forest lands in 8.1MP would not change under this alternative. Past, present, and foreseeable activities on private lands in the analysis area and elsewhere are not expected to change the current levels or conditions of 8.1MP.

Road Effects upon Wildlife

Because Alternative 2 proposes the decommissioning of approximately 40 miles of existing, non-system roads within the project area, it would reduce the existing road density within the project area from 2.7 mi. /sq. mi to 2.3 mi/sq. mi. This road density estimate includes all State, County, Private, and USFS System roads that would likely be maintained within the project area if this alternative is implemented. If the temporary roads that would be constructed in this Alternative are added to the equation, the road density within the project area would be 2.4 mi. /sq. mi., which is still a reduction from the existing road density. Temporary roads are to be decommissioned once management activities are done.

Based upon research by King and DeGraaf (2002), a road density of 2.4 mi. /sq. mile is below the threshold at which significant negative effects on forest birds generally appear. With a road density of 1.2 miles of system road/sq. mile of National Forest, the road density for the National Forest in the project area is also well below the Forest Plan's maximum density limit (FLMP IV-131). This indicates that the road density is not at a level which would jeopardize any wildlife species' continued viability within the project area.

In Alternative 2, approximately 16,320 acres would be considered within the "road effect zone." If temporary roads that would be constructed in this alternative are added to the equation, then 16,535 acres would fall within this zone. Some wildlife species would be expected to avoid this "road effect zone" due to the likelihood that road noise, human activities, and edge effects would be greater within this zone than outside it. In particular, activities that may impact game species, such as hunting, trapping, and poaching, would be expected to be higher within this zone than outside it because these areas are more easily accessed by people. Other activities, such as gathering plant materials for medicinal or commercial uses and general wildlife observation, would also be expected to be higher within these zones. These zones would also be most likely to harbor or introduce non-native plant species, many of which are considered noxious weeds.

In this alternative, the contribution that roads may be making within the project area to overall fragmentation of interior forest habitat would be improved when compared to the existing situation. Because 40 miles of non-system roads would be decommissioned under this alternative, there would be an expected

reduction in edge effect that may be occurring as a result of existing roads in the project area. Temporary roads would not be considered likely to increase the edge effect or fragmentation of habitat within the project area because of their temporary nature and narrow widths (26 ft; < 8 m). No new, permanent roads would be constructed under this alternative; therefore, there would be no increase in fragmentation or edge effect as a result of new permanent roads on National Forest.

Currently, there are approximately 5 blocks of National Forest within the project area that are > 500 acres and are not crossed by any known roads (i.e. "road-free"). In Alternative 2, this number would increase from 5 to 7, due to the decommissioning of 40 miles of non-system roads. However, within 3 of these blocks, some of this mature forest interior habitat would be temporarily fragmented by some of the temporary roads and timber regeneration activities proposed in this alternative. Areas that do not have permanent roads and do not have timber regeneration activities occurring within them would offer the best habitat for species that require large tracts of mature forest. For species that are more tolerant of habitat fragmentation, but tend to avoid areas of human activity, all of the "road-free" areas would offer them the best suitable habitat on National Forest in the project area, regardless of whether or not timber regeneration activities occurred in these blocks.

No unique communities or rare or listed-species would be expected to be further impacted directly by roads under Alternative 2. Although some unique plant communities, especially glades and seeps, occur immediately adjacent to some of the roads within the project area and within areas where temporary roads would be constructed, adverse effects to these unique communities as a result of roads would not be expected to occur under Alternative 2 because protective measures have been incorporated within this alternative to protect these unique communities and species sites from potentially disturbing activities associated with road decommissioning and temporary road construction. There are no federally threatened, endangered, or candidate species known to occur within any of the "road effect zones" or within the influence of any roads in the project area.

Table WL-16. Summary of Road Effects Indices for Alternative 2

Units of Measure		Potential Effects upon Wildlife
Road Density of all roads in project area	2.3 mi./sq. mi.	As road density increases, negative impacts upon wildlife such as habitat disturbance, road kill, and changes in their population distributions would likely also increase.
Acres within "Road Effect Zones"	16,320	These zones represent areas in which wildlife species would be most vulnerable to human activities and habitat conditions created by the roads.
No. of "road-free" areas > 500 acres on National Forest within project area	7	These areas would offer the best blocks of habitat on National Forest in the project area for species that tend to avoid roads and human use areas.

Units of Measure		Potential Effects upon Wildlife
No. of "road-free" areas > 500 acres on National Forest within project area that would not be affected by timber regeneration activities	4	These areas represent the best blocks of habitat on National Forest in the project area for species that require large tracts of mature, forest interior habitat.

Management Indicator Species

Direct and Indirect Effects:

Pileated woodpecker: Alternative 2 is expected to have the same effect upon pileated woodpeckers and their habitat as is described for Alternative 1. The reduction of mature forest with > 80% canopy cover (considered suitable pileated woodpecker habitat) would be slightly greater in Alternative 2 than in Alternative 1. Therefore, the effects described in Alternative 1 for pileated woodpecker would be slightly amplified in Alternative 2.

Ovenbird: Alternative 2 is expected to have the same effect upon ovenbirds and their habitat as is described for Alternative 1. Overall, Alternative 2 would reduce mature forest habitat in the analysis area temporarily, which would have a negative effect upon ovenbirds. However, many of the proposed stand treatments, as well as prescribed burning, would also slightly improve their habitat by increasing the shrub component. In general, however, Alternative 2 is expected to temporarily reduce habitat for ovenbirds in the analysis area to a slightly greater extent than Alternative 1.

Wild Turkey: Alternative 2 is expected to have the same effect upon wild turkeys and their habitat as is described for Alternative 1. Alternative 2 is expected to have the same level of effect upon mast producing stands and water availability as Alternative 1. However, Alternative 2 would likely slightly increase the forb and shrub component of forested stands in the analysis area more than Alternative 1, so this habitat condition for wild turkeys would be improved slightly more by Alternative 2 than Alternative 1.

White-tailed deer: Effects upon white-tailed deer and their habitat are expected to be the same as those described for wild turkey in Alternative 2.

Raccoon: Alternative 2 is expected to have the same effect upon raccoons and their habitat as is described for Alternative 1. The availability of mature forest habitat > 50 years of age would be the same for both alternatives. Alternative 2 would result in slightly more shrub and forb habitat than Alternative 1, which would benefit raccoons, and so, may have a slightly more beneficial effect upon raccoons and their habitat than Alternative 1.

Wood thrush: Effects upon wood thrushes and their habitats are expected to be the same as those described for ovenbird in Alternative 2.

Ruffed grouse: Alternative 2 is expected to have the same effect upon ruffed grouse and their habitat as is described for Alternative 1. Both alternatives would improve habitat conditions for the ruffed grouse; however, Alternative 2 may improve conditions slightly more than Alternative 1, since it includes activities such as glade restoration and some additional forest stand treatments. These activities would increase the stem density and shrub/forb component of stands within the analysis area.

Bobcat: Alternative 2 is expected to have the same effect upon bobcats and their habitat as is described for Alternative 1. Under Alternative 2, the levels of woodland habitat > 50 years of age with a dense understory are slightly greater than under Alternative 1. Therefore, Alternative 2 may improve habitat conditions for bobcats slightly more than Alternative 1.

Indigo bunting: Effects upon indigo buntings and their habitats are expected to be the same as those described for ruffed grouse in Alternative 2.

Cumulative Effects:

The cumulative effects of Alternative 2 upon MIS and their habitats are expected to be similar to those described for Alternative 1. Alternative 2 would create slightly higher levels of early successional habitat and forest stands with a shrub/forb component than Alternative 1. Therefore, potential for beneficial cumulative effects upon MIS that prefer these habitat conditions (i.e., wild turkey, white-tailed deer, raccoon, ruffed grouse and indigo bunting) would likely be somewhat higher under Alternative 2 than Alternative 1.

Alternative 2 is expected to temporarily reduce some habitat for the pileated woodpecker, ovenbird, and wood thrush within the analysis area, however, not to the extent that population levels of these species would be expected to decline significantly within the analysis area or throughout their ranges. Although the pileated woodpecker is showing declines state-wide, on the Ozark-Ouachita Plateau, populations seem to be increasing, and although Alternative 2 may not contribute to this increase, activities proposed would not jeopardize the continued viability or abundance of this species. Ovenbird and wood thrush are showing population increases throughout the state and on the Ozark-Ouachita plateau. The majority of the analysis area, including private lands, would continue to offer suitable habitat for these three species if Alternative 2 is implemented, and no adverse cumulative effects upon these species' population levels are anticipated.

Federally Threatened and Endangered Species

The determination of effects of Alternative 2 upon federally threatened and endangered species are the same as described in Alternative 1. The degree to which each of these alternatives affects each species and the rationale for these determinations of effects can be found in the BAE prepared for this analysis (Appendix A).

Regional Forester's Sensitive Species and other Species of Concern

The determination of effects of Alternative 2 upon RFSS and other Species of Concern are the same as described in Alternative 1. The degree to which each of these alternatives affects each species and the rationale for these determinations of effects can be found in the BAE prepared for this analysis (Appendix A).

Specialized Habitats

Springs, seeps & fens: The effects of Alternative 2 upon seeps and fens and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Seep/Fen-associated species."

Riparian areas: The effects of Alternative 2 upon riparian areas and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Riparian-associated species."

Bottomland hardwood forests: The direct and indirect effects of Alternative 2 upon bottomland hardwood forest would be similar to those described for riparian areas.

Glades: The effects of Alternative 2 upon glades and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "glade-associated species."

Shortleaf pine forest: Alternative 2 implement several stand treatments that are intended to regenerate shortleaf pine within the analysis area. While some mature pine stands may be lost in the short term to these activities, over the long term, these activities would help to sustain pine within the analysis area. Without these stand regenerating activities, many existing pine stands would likely

become more hardwood dominated. Also, because Alternative 2 would allow removal of wood products following stand treatments, the potential for natural pine regeneration within these stands would be higher than if these materials were not removed; otherwise, tree tops and stems would cover a large percentage of the forest floor in these stands following treatment, impeding pine regeneration. Prescribed burning proposed under Alternative 2 would also improve conditions for shortleaf pine by creating more open stand conditions and reducing leaf litter, which would encourage natural pine regeneration.

Fishless ponds and temporary pools: Alternative 2 would increase the number of fishless ponds and temporary pools within the analysis area. Under this alternative, fishless ponds and temporary pools would be developed within the analysis area at the same level as proposed in Alternative 1, and some existing ponds would be maintained. This would improve habitat conditions for species that require this specialized habitat.

Birds (emphasizing Neotropical Migrants)

Direct, Indirect, and Cumulative Effects

Effects upon birds and their populations are expected to be the same under Alternative 2 as described for Alternative 1. Alternative 2 would increase the availability of early successional forest habitat slightly more than Alternative 1, however, not to the extent that effects upon birds would likely be different between the alternatives.

Alternative 3 (No Action)

Forest Plan Habitat Objectives for Wildlife

4.1 Management Prescription Direct and Indirect Effects: Alternative 3 does not propose any activities that would have a direct effect upon the eight wildlife habitat objectives that have been identified in the Forest Plan because this alternative would initiate no new active management within the analysis area.

By not implementing any habitat management activities within the analysis area, however, there are likely to be some indirect effects upon some of the wildlife habitat objectives.

Failure to implement any timber treatments that regenerate mature forest would result in a continuing decline in the 0-9 year age class. Over time, the percentage of National Forest in the 4.1 MP within the analysis area that is less than 9 years old would decline from its current 2.7% to 0.1% by 2008, and by 2013, none of this habitat would be available on National Forest in the analysis area, barring some unforeseen event such as a windstorm, tornado, or severe wildfire (Figure WL-2).

Correspondingly, the implementation of Alternative 3 would result in an increase in more mature forest stands within the 4.1 MP of the analysis area, particularly those stands that would meet old growth criteria. Over time, the percentage of National Forest in the analysis area that meets old growth criteria would increase from the existing 4.4% to 5.4% by 2008, and reach 7.8% by 2013, barring some unforeseen event that prevents these stands from reaching full maturity, such as an insect infestation, wildfire, or weather event (Figure WL-2). However, under Alternative 3, there would also be no designation of forest stands for future old growth; therefore, the distribution of old growth within the analysis area would not necessarily be contiguous or in large blocks within the analysis area, nor may there be any retention of these old growth stands beyond the next 10 year entry period (i.e., beyond 2013).

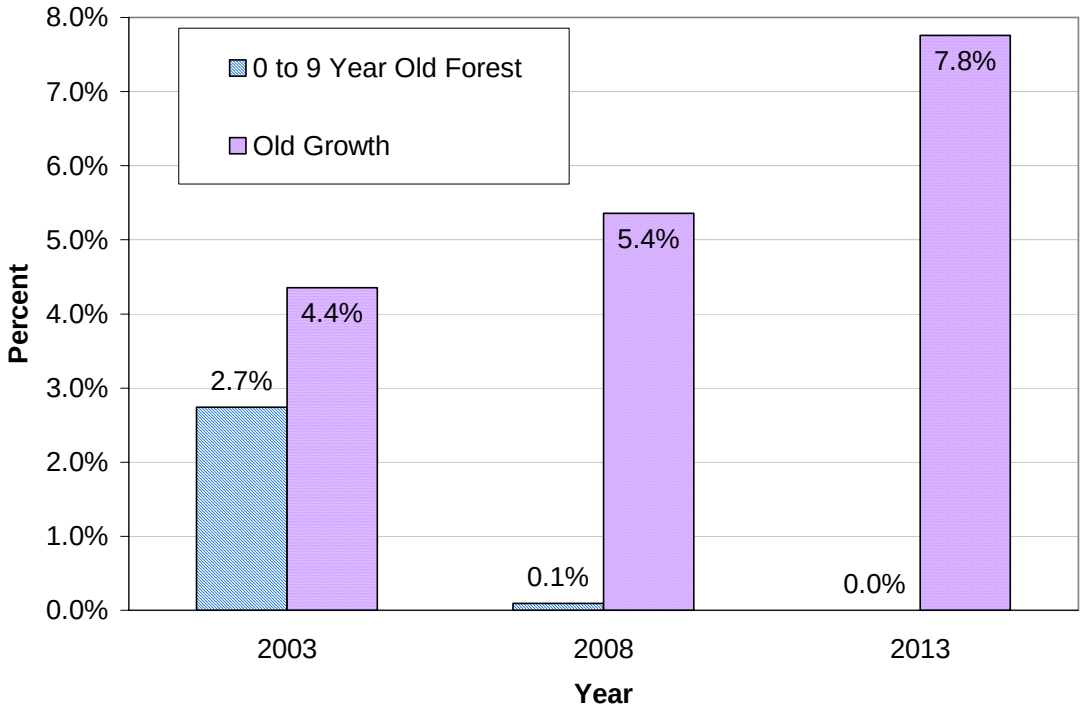

Figure WL-2. Projected levels of 0 to 9 year old forest and old growth within the 4.1 MP of the East Fredericktown analysis area for Alternative 3.

Along with an increase in old growth within the 4.1 MP of the analysis area, there would also be an expected increase in the oak and oak-pine forest types that are greater than 50 years of age. This increase is projected to be about 1% each five years; the current 62% of the analysis area that meets this objective is likely to increase to approximately 64.2% by the year 2013. Also, as these and other mature forest stands age, they would be expected to increase in canopy closure, since no stand-disturbing activities would occur within this alternative that may reduce or maintain existing canopy closures. As these stands mature, and canopies grow larger, the percentage of the 4.1 MP in the analysis area that has canopy closure greater than 80% would also be expected to increase from its existing 74%.

Conversely, as stands would continue to mature in this alternative without any stand disturbing activities, the amount of more open forest with less dense canopy cover would be expected to decrease. As canopy cover within these stands increases, the percentage of sawtimber habitat that has a condition of 20-30% forb, grass, or shrub ground cover would decrease. This decrease would be due to the gradual lack of sunlight that reaches the forest floor as stand canopies continue to become more dense and closed. Because most grasses, forbs and many shrubs are shade-intolerant, the lack of sunlight upon the forest floor would reduce the existing shrub, grass, and forb layer and preclude the growth of new understory. For the same reasons, the percentage of woodland habitat in the oak type over 50 years of age with a dense understory and the amount of open and semi-open habitat within the 4.1 MP of the analysis area would also be expected to decrease over time.

Alternative 3 would not involve the creation or maintenance of any water sources for wildlife. Therefore, the amount of permanent water per square mile within the 4.1 MP of the analysis area would not be increased from the existing 0.8 per square mile. Over time, without maintenance of existing water sources, such as upland ponds, the

availability of water for wildlife within the analysis area would be expected to decrease, as these existing ponds begin to fill in with sediments and vegetation.

4.1 Management Prescription Cumulative Effects: The cumulative effects of implementing Alternative 3 are based upon knowledge of the current conditions, past activities, other present activities being considered, and reasonable foreseeable activities in the analysis area. Also considered are the current and foreseeable conditions of the National Forest at a landscape scale, as well as adjacent private lands.

The foreseeable cumulative effect that implementation of Alternative 3 would have upon the eight wildlife habitat objectives identified for the 4.1 MP would be an overall decrease in early successional forest and open or semi-open habitat, and a lack of diverse forest understory represented by grasses, forbs and shrubs. Habitat objectives that focus on mature forest stands with a dense forest canopy would be expected to increase throughout the analysis area and within the 4.1 MP with implementation of Alternative 3. This may lead to a cumulative increase in forest conditions that benefit species preferring old growth conditions and deeply shaded forests.

When combined with past, present and foreseeable activities on both National Forest and private lands, these cumulative effects are expected to be most pronounced on the National Forest. Given that 76% of the private land within the analysis area is currently forested and 13% of this appears to have been recently harvested, it is assumed that early successional forest habitat within the analysis area would continue to be provided on private lands even if Alternative 3 is implemented. This assumes that stand disturbing activities such as timber harvesting would be ongoing at its current levels on private lands.

8.1 Management Prescription Direct and Indirect Effects: Alternative 3 would have no direct effect upon areas that currently fall within the 8.1 MP in the analysis area because it would involve no activities that would directly change the existing character of these areas. The acres of forest that currently fall within the 8.1MP would not change under this alternative.

Alternative 3 would indirectly affect these areas by allowing them to continue to mature without any stand disturbing activities. As a result, these stands would gradually become more closed-canopy and favor shade-tolerant species. For "Salamander Hollow," this would likely be a beneficial effect upon its characteristics, since it has been designated an 8.1 MP due to being in a riparian corridor that supports several mature forest species and is desired to eventually reach old growth conditions. For "Bidwell Creek glade" and "Wash Creek fen," this would likely be an indirect negative effect, because glades and fens are historically maintained by low intensity burning and support many rare species that require open, sunny conditions. As the forest matures around the glade and fen, these species could gradually become suppressed and out-competed by encroaching vegetation and more shade-tolerant species.

8.1 Management Prescription Cumulative Effects: There are no foreseeable effects upon this MP within the analysis area. Existing levels of National Forest lands in 8.1MP would not change under this alternative. Past, present, and foreseeable activities on private lands in the analysis area and elsewhere are not expected to change the current levels or conditions of 8.1MP.

Road Effects Upon Wildlife

Under Alternative 3, there would be no change in the existing road density on National Forest within the project area because no new roads would be constructed as part of this alternative and no existing roads would be decommissioned. Currently, the road density within the project area is approximately 2.7 mi. /sq. mi. This road density estimate includes all State, County, Private, and USFS System and Non-System roads that have been identified within the project area.

Based upon research by King and DeGraaf (2002), a road density of 2.7 miles/sq. mile is at or below the threshold at which significant negative effects on forest birds generally appear. With a road density of 1.2 miles of system road/sq. mile of National Forest, the road density for the National Forest in the project area is also well below the Forest Plan's maximum density limit (FLMP IV-131). This indicates that the road density is not at a level which would jeopardize any wildlife species' continued viability within the project area.

In Alternative 3, approximately 17,135 acres would be considered within the "road effect zone." Some wildlife species would be expected to avoid this "road effect zone" due to the likelihood that road noise, human activities, and edge effects would be greater within this zone than outside it. In particular, activities that may impact game species, such as hunting, trapping, and poaching, would be expected to be higher within this zone than outside it because these areas are more easily accessed by people. Other activities, such as gathering plant materials for medicinal or commercial uses and general wildlife observation, would also be expected to be higher within these zones. These zones would also be most likely to harbor or introduce non-native plant species, many of which are considered noxious weeds.

The contribution that roads may be making within the project area to overall fragmentation of interior forest habitat would not change from the existing situation under Alternative 3. Because no roads would be decommissioned under this alternative, there would be no reduction in edge effect that may be occurring as a result of existing roads in the project area. Conversely, no new roads would be constructed under this alternative; therefore, there would be no increase in fragmentation or edge effect as a result of new roads on National Forest.

Currently, there are approximately 5 blocks of National Forest within the project area that are > 500 acres and are not crossed by any permanent roads (i.e., "road-free"). In Alternative 3, these 5 blocks would remain uncrossed by roads. Also, unlike in Alternatives 1 and 2, under Alternative 3, none of these blocks would be temporarily fragmented by any other activities proposed in this alternative. Therefore, these 5 blocks would offer the best habitat for species that require large tracts of mature National Forest and for species that have less specific habitat requirements but tend to avoid areas of human activity.

No unique communities or rare or listed-species would be expected to be further impacted directly by roads under Alternative 3. Although some unique plant communities, especially glades and seeps, occur immediately adjacent to some of the roads within the project area, effects to these unique communities as a result of roads would not be expected to change from the existing situation because this alternative does not propose any changes to the existing road conditions, locations, or maintenance. There are no federally threatened, endangered, or candidate species known to occur within any of the "road effect zones" or within the influence of any roads in the project area.

Table WL-17. Summary of Road Effects Indices for Alternative 3

Units of Measure		Potential Effects upon Wildlife
Road Density of all roads in project area	2.7 mi./sq. mi.	As road density increases, negative impacts upon wildlife such as habitat disturbance, road kill, and changes in their population distributions would likely also increase.
Acres within "Road Effect Zones"	17,135	These zones represent areas in which wildlife species would be most vulnerable to human activities and habitat conditions created by the roads.
No. of "road-free" areas > 500 acres on National Forest within project area	5	These areas would offer the best blocks of habitat on National Forest in the project area for species that tend to avoid roads and human use areas.
No. of "road-free" areas > 500 acres on National Forest within project area that would not be affected by timber regeneration activities	5	These areas represent the best blocks of habitat on National Forest in the project area for species that require large tracts of mature, forest interior habitat.

Management Indicator Species

Direct and Indirect Effects:

Pileated Woodpecker: The pileated woodpecker is considered an indicator species for wildlife that require large tracts of mature forest. This species is also a cavity nester and requires large snags within a forested landscape. Alternative 3 would be expected to have no direct effect upon pileated woodpecker populations. However, with implementation of Alternative 3, habitat for this species is likely to indirectly increase. Alternative 3 would result in ongoing maturation of forest stands within the analysis area. This would result in increased large snag availability as stands mature and individual trees begin to die. The increase in forest stands that reach old growth conditions within the analysis area would also provide habitat for this species and other species associated with mature forests. Of the eight habitat objectives identified for the 4.1 MP, the habitat objectives for old growth and woodland habitat in the oak and oak-pine types over 50 years of age would best represent habitat objectives for pileated woodpecker. Under Alternative 3, habitat that meets these two objectives is expected to increase.

Ovenbird: The effects of Alternative 3 upon ovenbird populations and their habitats would be similar to the effects discussed for pileated woodpecker. However, unlike pileated woodpeckers, ovenbirds require a dense understory and do not nest in cavities, but rather, on the ground. Alternative 3 would not likely result in a loss of habitat for ovenbirds due to the continuing maturation of the forest and increase in availability of large tracts of forest. However, this species would also not be benefited by the increase in shrub layer that often comes with stand-disturbing activities. Of the eight habitat objectives identified for the 4.1 MP, the habitat objective of woodland habitat in the oak type over 50 years of age with dense understory would best represent habitat objectives for ovenbirds. Under Alternative 3, habitat that meets this objective is expected to remain near its current levels in the short term, but decrease over time.

Wild Turkey: The wild turkey can be found in a variety of habitats and utilizes different habitats during different phases of its life. For the most part, this is a species considered dependent upon mature oak-hickory forest, primarily because it feeds heavily on acorns and hard mast. However, it is just as

frequently found on edges of forest and in semi-open conditions, especially during breeding season or when feeding young. Generally speaking, Alternative 3 would not be expected to affect wild turkey populations, because this alternative would continue the availability of mature oak-hickory forest in the analysis area. However, over time, the loss of soft mast in open and semi-open habitats could have a slight impact upon individual wild turkeys that use these areas for feeding. However, this loss would not be expected to affect wild turkey populations due to the wide availability of alternative feeding areas in the analysis area. Wild turkeys are also somewhat dependent upon the availability of water within the forested landscape, and in some cases, lack of adequate water sources may be a limiting factor for this species.

Of the eight habitat objectives identified for the 4.1 MP, the habitat objectives of woodland sawtimber habitat in the oak, oak-pine, and pine type that has a condition of 20-30% forbs, grass, and shrub ground cover, as well as the objective of woodland habitat in the oak type over 50 years of age with dense understory and open and semi-open lands, would best represent habitat objectives for wild turkeys during most of their life cycle. Under Alternative 3, habitat that meets these two objectives is expected to remain near its current levels in the short term, but decrease over time.

White-tailed deer: The general habitat requirements for the white-tailed deer are very similar to that of the wild turkey. As a result, effects of Alternative 3 upon deer are expected to be similar to those described for wild turkey.

Raccoon: The raccoon is found in a variety of forested landscapes. This species is less dependent upon the size and distribution of forest, than it is upon the presence of large diameter den trees. Raccoons are typically found in areas near mature oak forests and would prefer some tracts of forest to support large diameter trees that can be utilized as dens and some shrub understory, since a large part of the raccoon's diet is comprised of berries and fruits that come from shrubs. Raccoons are also frequently associated with water and would benefit from a good distribution of water sources across the landscape.

Of the eight habitat objectives identified for the 4.1 MP, the habitat objectives of woodland sawtimber habitat in the oak, oak-pine, and pine type that has a condition of 20-30% forbs, grass, and shrub ground cover, as well at the objective of woodland habitat in the oak type over 50 years of age with dense understory and open and semi-open lands, would best represent habitat objectives for raccoons during most of their life cycle. Both habitat objectives require trees greater than 50 years of age, which would be more likely to produce large diameter den trees. These two objectives also require a shrub component, which would provide a food source for raccoons. Under Alternative 3, habitat that meets these two objectives is expected to remain near its current levels in the short term, but decrease over time.

Wood thrush: The general habitat requirements for the wood thrush are very similar to that of the ovenbird. The biggest difference between the two would be that wood thrushes seem to prefer somewhat damper, heavily shaded environments, often along ravines. However, because the habitat requirements for wood thrush are similar to that of ovenbirds, the effects of Alternative 3 upon the wood thrush are expected to be similar to those described for the ovenbird.

Ruffed grouse: A key habitat requirement for the ruffed grouse is the presence of forest stands that contain a high stem density. This high stem density can be provided in many forms, but is most often provided by very early successional forest habitat. It may also be found occasionally in infrequently burned or mowed fields, power line corridors, or roadsides. This high stem density provides the ruffed grouse with both cover and often food,

since this type of habitat often produces high yields of soft mast, such as blackberries, sumac berries, seeds, etc.

Alternative 3, however, would not improve habitat conditions for the ruffed grouse because it would not involve any activities that would create early successional forest or other areas of high stem density. Rather, Alternative 3 would be more likely to result in creation of forest stands with low stem density because stem density generally decreases as forest stands mature.

Of the eight habitat objectives identified for the 4.1 MP, the habitat objectives of 0 to 9 year old forest and open and semi-open habitat would best represent habitat objectives for ruffed grouse. Under Alternative 3, the amount of habitat within the analysis that would meet these objectives would not increase and would be expected to decrease over time.

Bobcat: Bobcats are very secretive creatures, but research indicates that they typically are found in large-scale, forested environments that have a mixture of scrub-shrub habitats and openings interspersed with more mature forest. Bobcats feed heavily upon small mammals, particularly rabbits, and would be expected to prefer a forested landscape that contains good amounts of shrubby habitat for rabbits. Bobcats also prefer shrub habitat for shelter and bedding areas.

Given this, the bobcat's habitat is probably best represented by the habitat objective of woodland habitat in the oak type over 50 years of age with a dense understory. This objective would provide bobcats with a mature forest setting, in which a dense shrub layer exists to provide shelter and food. In Alternative 3, the amount of habitat that meets this objective is expected to remain near its current levels, but decline over time.

Indigo bunting: Like the ruffed grouse, the indigo bunting is also a species that prefers scrub-shrub habitat with a high stem density. However, unlike the ruffed grouse, the indigo bunting can often be found in very small pockets of this habitat and is often found in parks, backyards, and hedgerows.

Because of its similar habitat requirements to the ruffed grouse, the effects of Alternative 3 upon the indigo bunting are similar to those described for ruffed grouse.

Cumulative Effects

Pileated woodpecker, Ruffed grouse, Indigo bunting and Wild turkey: These four MIS species are showing population declines either state-wide or on the Ozark-Ouachita Plateau. The contribution of Alternative 3 to these declines would be considered negligible, given the size of the analysis area to the overall Plateau. For ruffed grouse, indigo bunting, and wild turkey, Alternative 3 does not propose any activities that would directly or indirectly improve habitat conditions for these three species; therefore, this alternative would also not create any cumulative beneficial effects that could increase or stabilize these populations over the long-term.

Alternative 3 is expected to improve habitat conditions for the pileated woodpecker within the analysis area. Although the pileated woodpecker is showing declines state-wide, on the Ozark-Ouachita Plateau, populations seem to be increasing, and Alternative 3 is expected to contribute to this increase.

Ovenbird, Wood thrush, White-tailed deer, Raccoon and Bobcat: Populations of these five MIS are considered to be either increasing or stable both state-wide and on the Ozark/Ouachita Plateau. The implementation of Alternative 3, when considered in conjunction with known past, present, and foreseeable activities on both private and public lands in the analysis area, is expected to maintain habitat conditions for these MIS similar to the current conditions. Although

there may be some decrease in the shrub component of forest stands within the analysis area under this alternative, this loss is not expected to be great enough to have a cumulative negative effect upon the populations of these species in the analysis area or elsewhere.

Federally Threatened and Endangered Species

The effects of Alternative 3 upon federally threatened, endangered, and proposed species of the Mark Twain National Forest have been disclosed in a Biological Evaluation/Assessment (BAE) that was prepared specifically for this analysis. The BAE can be found in Appendix A.

The BAE determined that Alternative 3 would have "no effects" upon five species and "is not likely to adversely affect" seven species (Table WL-18). These effects include all direct, indirect, and foreseeable cumulative effects. The rationale and discussions for these determinations of effects for each species can be found in the BAE.

Table WL-18. Summary of effects of Alternative 3 upon federally-listed species.

Species	Determination of Effect	Species	Determination of Effect
Topeka shiner	No effects	Running buffalo clove	Is not likely to adversely affect
Tumbling creek cavesnail	No effects	Mead's milkweed	Is not likely to adversely affect
Gray bat	Is not likely to adversely affect	Pink mucket pearlymussel	No effects
Indiana bat	Is not likely to adversely affect	Ozark hellbender	No effects
Bald eagle	Is not likely to adversely affect	Scaleshell mussel	No effects
Hine's emerald dragonfly	Is not likely to adversely affect	Curtis' pearlymussel	Is not likely to adversely affect

Regional Forester's Sensitive Species and other Species of Concern

The effects of Alternative 3 upon Regional Forester's Sensitive Species and other Species of Concern of the Mark Twain National Forest have been disclosed in a Biological Evaluation/Assessment (BAE) that was prepared specifically for this analysis. The BAE can be found in Appendix A.

The BAE determined that Alternative 3 would have "no impact" upon any RFSS or Species of Concern. The rationale and discussion for this determination can be found in the BAE.

Specialized Habitats

Springs, seeps & fens: The effects of Alternative 3 upon seeps and fens and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Seep/Fen-associated species."

Riparian areas: The effects of Alternative 3 upon riparian areas and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "Riparian-associated species."

Bottomland hardwood forests: The direct and indirect effects of Alternative 3 upon bottomland hardwood forest would be similar to those described for riparian areas.

Glades: The effects of Alternative 3 upon glades and their associated species are described in the BAE prepared for RFSS and other Species of Concern (Appendix A) under the subsection "glade-associated species".

Shortleaf pine forest: Alternative 3 would have no direct impact upon the shortleaf pine forest because no activities would occur under this alternative that would directly disturb this habitat. Alternative 3 may have an indirect effect upon the shortleaf pine forest, however, because no direct disturbance would occur to forest stands under this alternative. Shortleaf pine is considered a "disturbance species," and generally responds favorably to activities such as burning, timber treatments, and other activities that open the forest canopy. Under Alternative 3, none of these types of activities would occur. As a result, existing shortleaf pine stands would gradually succumb to more shade tolerant species. Over many decades, this lack of disturbance would likely result in more hardwood stands and fewer shortleaf pine stands within the analysis area.

Fishless ponds and temporary pools: Alternative 3 would not have a direct effect upon any fishless ponds or pools because it does not propose any activities that would impact these habitats. Over time, this alternative may lead to a loss of ponds and pools within the analysis area because there would be no maintenance of existing ponds and no new pond construction. Some of this habitat would be provided by existing road ruts and mud holes in the analysis area, which would remain under Alternative 3; however, these ruts and mud holes are heavily disturbed by traffic and offer only marginal habitat for species dependent upon this specialized habitat.

Birds (emphasizing Neotropical Migrants)

Direct and Indirect Effects: Alternative 3 would have no direct effects upon birds. Indirectly, this alternative would benefit species that prefer mature forest stands because it would not implement any activities that would result in younger forest stands or scrub-shrub habitat within the analysis area. Under Alternative 3, fragmentation of mature forest habitat would not be increased by any proposed actions on National Forest and increases in cowbird parasitism as a result of increased edge within the National Forest would not be expected. Species that occupy closed-canopy forests would be expected to remain at the current levels or increase slightly within the analysis area. Habitat for birds that occupy early successional forest and openings within the forest would continue to be limited within the analysis area and not increased under this alternative.

Cumulative Effects: Across the Ozark/Ouachita physiographic area, many species of birds that are considered priority species for conservation (identified in Table WL-5) are considered species that prefer or are favored by open woods or scrub-shrub or grassland habitat. Several of these species would benefit especially from frequent burning that maintains a semi-open canopy of mature trees, with an understory of shrubs and grasses. Declines in several of these species are being observed across the physiographic area, and Alternative 3 would not implement any activities that would benefit these species by providing their desired habitat. Therefore, while this alternative would not have a direct negative effect upon these species, it may have a cumulative negative effect upon species that are in decline across the physiographic area and prefer more open environments or dense shrub understories.

Table WL-19. Anticipated effects of Alternative 3 upon Partners in Flight priority species for the Ozark/Ouachita physiographic area that are likely to occur within the analysis area.

Species	Preferred Habitat	Effect of Alternative 3
Kentucky warbler, Prairie warbler, Whip-poor-will, Field sparrow, Orchard oriole, Northern bobwhite, Brown thrasher, Chuck-will's widow, Blue-winged warbler, Loggerhead shrike, , Bewick's wren	Forest edge, young sapling/poletimber forest, scrub-shrub, fields, or openlands, often intermixed with mature forest.	Would not improve habitat conditions for these species. Habitat for these species expected to be reduced over the long term.
Swainson' warbler, Cerulean warbler, Acadian flycatcher, Prothonotary warbler, Louisiana waterthrush, Yellow-throated warbler, Rusty blackbird	Mature riparian forests, often with some midstory and shrub development	Would maintain existing mature riparian forest. Would not encourage shrub development in the midstory and understory.
Worm-eating warbler, Great-crested flycatcher, Ovenbird, Pileated woodpecker, Carolina chickadee, Yellow-billed cuckoo, Yellow-throated warbler, Summer tanager, Wood thrush, Red-headed woodpecker, Purple finch	Mature forest with semi-open canopies and relatively open midstory and some shrub development	Would maintain and increase availability of mature forest in the analysis area. Would not improve conditions for species that prefer semi-open canopies or shrub development in the midstory and understory.

FISHERIES AND AQUATICS - EXISTING CONDITION OF FISHERIES AND AQUATICS

In the revised edition of "The Fishes of Missouri" dated 1997, William L. Pflieger described four aquatic faunal regions: the Prairie, Ozark, Lowland, and Big River. The geographic location of the East Fredericktown Project Area places it in the eastern part of the "Ozark Aquatic Faunal Region". There are approximately 67 species, or nearly one-third of all Missouri fishes, in the "Ozark Aquatic Faunal Region".

The Castor River and Whitewater River are part of the Headwater Division Watershed. The Castor River from T34N,R8E,S19 to T34N,R8E,S7 (total of 2 miles) is classed as intermittent, gaining and designated for livestock and wildlife watering and protection of warm water aquatic life and human health-fish consumption. The Castor River from T29N,R9E,S29 to T34N,R8E,S19 (total of 59 miles) is classed as perennial, gaining and designated for: livestock and wildlife watering, protection of warm water aquatic life and human health-fish consumption, cool water fishery, whole body contact recreation, and boating and canoeing. The Whitewater River from T34N,R9E,S29 to T34NR8ES10 (total of 6.5 miles) is classed as intermittent and designated for livestock and wildlife watering and protection of warm water aquatic life and human health-fish consumption.

Saline Creek is part of the Mississippi Lowland Watershed. Saline Creek from T35N,R8E,S16 to T35N,R7E,S11 (total 3 miles) is classed as intermittent, gaining and designated for livestock and wildlife watering and protection of warm water aquatic life and human health-fish consumption. Saline Creek from T36N,R9E,S13 to T35N,R8E,S16 (total of 12 miles) is classed as perennial, gaining and designated for livestock and wildlife watering, protection of warm water aquatic life and human health-fish consumption, cool water fishery, and whole body contact recreation.

There are no lakes or ponds on National Forest lands within the Project area which are managed for fisheries.

The Missouri Department of Conservation, (MDC) Fisheries Division, Jefferson City, MO conducted a "Watershed Inventory and Assessment of the Diversion Channel". The MDC pollution inventory and assessment concluded the widespread distribution of 29 intolerant fish species indicated good water quality and fish habitat within the watershed. http://www.conservation.state.mo.us/fish/watershed/mdc40.htm

The Missouri Department of Conservation, Research Division, Columbia, MO maintains a current and comprehensive fish inventory in a GIS formatted data base. There are seven fish sampling sites within the Project Area, all along the Castor River. The fish sample site numbers are 0552, 0629, 2225, 0584, 0594, 0630, and 2136. A list of species for each fish site can be found in the Project files. There are approximately 51 fish species represented in the seven sample sites listed above. The Castor River is a cool water fishery, with management emphasis on smallmouth bass and goggle eye (also called shadow bass). There are no fish sample sites within the Project area on Saline Creek and Whitewater River because only the headwaters of these streams exist within the project area.

The Castor River and Saline Creek are considered reference streams for the Ecological Drainage Units (EDU) established by Missouri Department of Natural Resources (MDNR). An EDU is a region in which similar biological communities are expected to be found. The MDNR maintains a sampling site (0119521) on the Castor River located in the SW1/4, Section 10, T33N, R8E, Madison County and a sampling site (0010169) on Saline Creek in NW1/4, Section 31, T36N, R9E, St. Genevieve County. Biological and chemical samples have been taken at each site. Results of the biological assessment are summarized by the Macroinvertebrate Stream Condition Index (MSCI), which ranges from 4 (very poor) to 20 (very good). From 1999-2001, five samples were taken from the Castor River site 0119521. Four of the samples scored 20 (very good) and one sample scored 16 (good). From 1999-2000, four samples were take from Saline Creek site 0010169. The scores for these four samples were 14 (fair to good), 18 (good), 20 (very good), and 18 (good). Surface water quality in the Castor River is excellent and surface water quality in Saline Creek is good. Stream waters of good quality are identified by the greater abundance of pollution-intolerant macroinvertebrate taxa, such as those in EPT (Ephemeroptera or mayflies, Plecoptera or stoneflies, Trichoptera or caddisflies). EPT are those kinds of invertebrates that serve as fish food. Degraded streams contained pollution-tolerant Oligochaeta or worms and burrowing Chironomids or midges which are not good fish foods. A summary of the MDNR biological and chemical samples taken at each site can be found in the Project Files.

FISHERIES AND AQUATICS - DIRECT AND INDIRECT EFFECTS

Direct & Indirect Effects Common to all Alternatives

Goals for the MTNF Fisheries Program can be found on pages IV - 2 & 3 of the LRMP. The primary fisheries goals for the MTNF are to Protect Aquatic ecosystems, Restore Degraded Aquatic Ecosystems and Enhance Aquatic Resources User Opportunities. Forest-Wide Standards and Guidelines for the MTNF Fisheries Program can be found on Pages IV - 49 & 49 - 1 of the LRMP. These are specific Forest-Wide Standards and Guidelines that apply to streams, lakes, and ponds.

Those fish species collected at MDC Fish Sampling Sites 0552, 0629, 2225, 0584, 0594,

0630, and 2136 are listed in the Project File. There were no Federal, RFSS, or Forest Species of Concern fish species collected at any sampling site. A Biological Evaluation (BE) for Federal listed species was completed and is located in Project File. Site-specific effects determinations for each species are summarized in this document. The BE discusses direct and indirect effects to Federal listed aquatic species and concludes that there will be no effects outside those evaluated in the programmatic Biological Assessment and Biological Opinion. The USDA Forest Service Eastern Region Sensitive Species (RFSS) BE is also located in the Project File. The RFSS BE concluded there would be no direct or indirect effects to R-9 listed aquatic species.

The existing and proposed road system will not restrict the migration and movement of aquatic organisms. There exist a total of four creek crossings. Three of the crossings are located across intermittent seasonally dry warm water stream of less than 1 CFS flow. One crossing is located on an intermittent with permanent pools warm water stream with a 1-4.9 CFS flow. All four creek crossing are Ford crossings where the stream bed serves as the road. Ford crossings provide a natural passageway for the migration and movement of aquatic organisms where the streambed has a firm rock or gravel bottom and road traffic is light.

Alternative 1

There will be no commercial timber harvest on National Forest lands; however, National Forest lands within the Project area will be managed to maintain a variety of forest age classes, sizes, structures, and native species. Non-roaded silvicultural activities will produce very little soil erosion or sediment yield when conducted outside the riparian area. The silvicultural activities proposed in this alternative are not significant sediment sources and will not have a direct or indirect effect on the fisheries resources.

The proposed prescribed burns, viewed at the right scale of time and space, would not have a negative impact on aquatic biota. The primary concern is how the fire accelerates the delivery of sediment to the surface water system. The intensity of a wildfire could have negative effects on streams by exposing mineral soil to sheet erosion; whereas, a low intensity prescribed fire which did not burn down to mineral soil, would not contribute a significant sediment load into Saline Creek, Castor River, or Whitewater River.

In this alternative decommissioning of unneeded roads would not occur. The amount of sediment entering stream water courses would most likely increase; however, it is doubtful this action by itself would cause changes to water quality which would impair MDNR designated uses, including the cool water fisheries.

Alternative 2

Nearly 90 percent of the erosion from timber harvesting can be traced to the logging road system (USEPA, 1993; MDNR, 2000). Soil erosion can results in sedimentation to streams. Sedimentation alters the natural relationship between the biota and the stream substrate by changing the condition of the substrate. Increased sedimentation can adversely affect the biota by reducing or covering their food supply and interfering with feeding and respiration (Water, 1995). The Best Management Practices (BMP) as described in Thomas F. Waters' Monograph 7 "Sediment in Streams", page127, "Methods for the reduction of erosion from logging roads" will be utilized in designing the logging road system (a description of the various methods Waters described can be found in the Project File). In addition, careful planning of road and skid trail system locations will reduce the amount of land disturbance by minimizing the area in roads and trails, thereby reducing erosion and sedimentation. Intercepting and retaining

sediment between the site of its origin and a receiving stream is 2nd best to preventing erosion; therefore, the skid trails and haul roads will be monitored to identify where maintenance is needed to prevent soil movement into stream courses. Use of BMP's will reduce the amount of sediment entering stream courses; therefore, commercial harvest activities will not adversely affect beneficial water uses, including "cool water fisheries" of the Castor River and Saline Creek.

The proposed prescribed burns, viewed at the right scale of time and space, would not have a negative impact on aquatic biota. The primary concern is how the fire accelerates the delivery of sediment to the surface water system. The intensity of a wildfire could have negative effects on streams by exposing mineral soil to sheet erosion; whereas, a low intensity prescribed fire which did not burn down to mineral soil, would not contribute a significant sediment load into Saline Creek, Castor River, or Whitewater River.

Siltation tops the list of the foremost 10 pollutants in rivers, half-again higher than the 2nd most important pollutant, nutrients (Waters, 1995; USEPA, 1993). Approximately 40 miles of non-system roads within the project area would be decommissioned. This action would reduce the sediment load into Saline Creek, Castor River, and Whitewater River.

Alternative 3

In this alternative current and on-going activities would continue, but no new management activities would be initiated. Approximately 40 miles of non-system roads within the project area would remain open under this alternative. The amount of sediment entering stream water courses would most likely increase; however, it is doubtful this action by itself would cause changes to water quality which would impair MDNR designated uses, including the cool water fisheries.

FISHERIES AND AQUATICS - CUMULATIVE EFFECTS

The area considered for cumulative effects is Saline Creek, Castor River, and Whitewater River. The time period considered for cumulative effects is the next 10 years.

Cumulative Effects Common to all Alternatives

Long term population and even species trends may change during the next decade, non-federal landowners will determine land uses on approximately 83% of the Project area. Stream channels morphology changes could occur without the protection of a riparian corridor and this could affect the numbers and types of aquatic species present.

Alternative 1

Over a 10-year period, Non-Point source contaminants of non-system roads (approximately 40+ miles) could contribute to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. These non-system roads within the project area would remain open under this alternative. Over this 10-year period, the amount of sediment entering stream water courses would most likely increase; however, it is doubtful this action by itself would cause changes to water quality associated with Saline Creek, Castor River, and Whitewater River which would impair MDNR designated uses.

Alternative 2

This Alternative has 33.5 miles of system roads as compared to the other alternatives which have 33.8 miles. This is not considered a significant difference; however, in this alternative approximately 40 miles of non-system roads within the project area would be

decommissioned. Over this 10-year period, the amount of sediment entering stream water courses would most likely decrease.

Alternative 3

Over a 10-year period, Non-Point source contaminants of non-system roads (approximately 40+ miles) could contribute to the amount of sediment entering Saline Creek, Castor River, and Whitewater River. These non-system roads within the project area would remain open under this alternative. Over this 10-year period, the amount of sediment entering stream water courses would most likely increase; however, it is doubtful this action by itself would cause changes to water quality associated with Saline Creek, Castor River, and Whitewater River which would impair MDNR designated uses.

Mitigation

Nearly 90 percent of the erosion from timber harvesting can be traced to the logging road system (USEPA, 1993; MDNR, 2000). The Best Management Practices (BMP) as described in Thomas F. Waters' Monograph 7 "Sediment in Streams", page127, "Methods for the reduction of erosion from logging roads" will be utilized in designing the logging road system (a description of the various methods Waters described can be found in the Project File).

Impacts from implementation of any action alternative would be indirect and non-significant provided mitigation measures SW1, SW2, SW3, SW4, SW5, SW6, SW7, SW8, and SW9, and the standard and guides in the Forest Plan are followed.

Monitoring

Skid trails and haul roads will be monitored to identify where maintenance is needed to prevent soil movement.

The Castor River and Saline Creek are considered reference streams for the Ecological Drainage Units (EDU) established by MDNR. It is expected MDNR will take additional biological and chemical samples during and after project implementation. These samples will be compared to existing conditions to determine what biologically and water quality values may have change and if project implementation may have been the cause for any change.

Project level monitoring is designed to determine whether or not the resource management objectives of the environmental analysis have been implemented as specified and whether or not the measures for mitigating the environmental effects were effective.

Implementation monitoring of project recommended mitigation measures and other project actions will be conducted.

Forest-wide project implementation audits would be conducted by Forest resource staff on a sample of randomly selected project areas on an annual basis. The East Fredericktown Project area could be included in this sample at any time and at any stage of the project planning and implementation process.

AIR QUALITY - EXISTING CONDITION

The climate in the area is defined by hot humid summers with temperatures ranging from 63 to 88 degrees Fahrenheit. The autumns are warm and moist with average temperatures ranging from 35 to 79 degrees Fahrenheit. The winters can be cold and snowy, with temperatures ranging from 18 to 43 degrees Fahrenheit. The springtime is cool and moist with temperatures ranging from 33 to 75 degrees Fahrenheit. The annual monthly precipitation ranges from a low in the winter of 1.70 inches to a high of 4.8 inches in the spring.

The major physiographic features influencing the climate, movement and dispersion of smoke in this area are the Castor River, and other small-entrenched valley areas. The valleys can act as cold sinks and trap smoke. The river valleys can act as drainages for the smoke causing it to flow down stream.

In general, the air quality in the Analysis Area is good. All six criteria pollutants (carbon monoxide, nitrogen dioxide, ozone, particulate matter, sulfur dioxide, and lead) are within National Ambient Air Quality Standards (NAAQS). Episodes of regional haze occur mainly in the spring and summer.

The entire proposed project lies within lands designated as Class II with respect to the air resource. The Clean Air Act (CAA) defines a Class II area as, "A geographic area designated for a moderate degree of protection from future degradation of the air quality". The closest Class I area is the USDI, Fish and Wildlife Service's Mingo Wilderness at the Mingo National Wildlife Refuge (Puxico, Missouri) located about 35 miles to the south. The CAA defines Class I areas as "A geographic area designated for the most stringent degree of protection from future degradation of air quality". The only other Class I area in the state is the Hercules Glade Wilderness on the Mark Twain National Forest. It is approximately 155 miles southwest of the Analysis Area.

The city of St. Louis and five counties in and around the city are the closest non-attainment areas. This determination is based on the Environmental Protection Agency's (EPA) Aerometric Information Retrieval System (AIRS) and data maps. EPA defines non-attainment areas, as "A geographic area in which the level of a criteria air pollutant is higher than the level allowed by the federal standards"(EPA). St. Louis and the surrounding counties are approximately 60 miles northeast; these areas are non-attainment for ozone. The Analysis Area is designated as attainment for all six NAAQS criteria pollutants. EPA defines attainment areas as "A geographic area in which levels of a criteria air pollutant **meets** the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant".

Of the six criteria pollutants identified by the EPA, the main pollutants of concern for this proposed project are: 1) carbon monoxide (CO), 2) particulate matter (PM-2.5 and PM 10), and 3) ozone (O3). Although the other 3 pollutants (oxides of nitrogen (NO2), oxides of sulfur (SO2) and lead (Pb) are important, the levels associated with this type of project are typically well below NAAQS.

The main sources of carbon monoxide are from combustion engines associated with vehicles, and outdoor burning. Major sources of PM-2.5 and PM-10 are wood burning home units, burning on private and federal lands, wildland fire, fugitive dust from un-surfaced roads and mineral development along the Viburnum Trend (see Minerals Section). Wildland and prescribed fires can also be sources of fugitive particulate matter less than 10 microns in size. There are no main sources of ozone in the proposed area. There are a few activities such as wildland burning, which can produce some of the precursors to ozone such as oxides of nitrogen and organic carbon.

Based on Forest Plan direction, the desired condition for the air resource in the Analysis Area is to maintain NAAQS, comply with state and local regulations and to protect Class I area Air Quality Related Values (AQRV's) from anthropogenic caused degradation. The AQRV(s) used for the Mingo Wilderness area is visibility. The applicable state and local regulation is 10CSR 10-3.030,4 (c.7), which deals with open burning in Missouri and general conformity as outlined by the CAA 176(c) and administered by the state.

AIR QUALITY - DIRECT AND INDIRECT EFFECTS

All analysis for the proposed management activities will be based on potential impacts to the identified smoke sensitive receptors with respect to the NAAQS levels for carbon monoxide, PM-10, PM-2.5, ozone and visibility. See Table 3-6 for the smoke sensitive receptors and Table 3-7 for the six criteria pollutants. The State of Missouri uses the same standards for the criteria pollutants as EPA.

Table 3-5 Smoke Sensitive Receptors within the Project Area.

Smoke Sensitive Receptors	Location in relation to Project Area
City of Fredericktown	West
City of Farmington	North west
City of Marquand	East
Silver Mines Recreation Area	West
Missouri State Highway 67	West
Missouri State Highway 72	East and West

The above smoke sensitive receptors were used to analyze the impacts of the various alternatives at these locations. They were chosen based in part on proximity to the proposed prescribed burns, known smoke concerns, safety concerns, and ability to represent similar locations in the area.

Table 3-6. National Ambient Air Quality Standards for the Six Criteria Pollutants

Pollutant	Averaging Period	National Ambient Air QualityStandards(NAAQS)	
		Primary	Secondary
Carbon Monoxide (CO)	8 hour average	9 ppm (10 mg/m3)	N/A
	1 hour average	35 ppm (40 mg/m3)	N/A
Nitrogen Dioxide (NO2)	Annual Arithmetic Mean	0.053 ppm (100 ug/m3)	Same as Primary
Ozone (O3)	8 hour average **	0.08 ppm (157 ug/m3)	Same as Primary
	1 hour average	0.12 ppm (235ug/m3)	Same as Primary
Particulate Matter with diameters Of 10 micrometers or less (PM-10)	Annual Arithmetic Mean	50 ug/m3	Same as Primary
	24 hour average	150 ug/m3	Same as Primary
Particulate Matter with diameters Of 2.5 micrometers or less (PM-2.5)	Annual Arithmetic Mean**	15 ug/m3	Same as Primary
	24 hour average **	65 ug/m3	Same as Primary

Pollutant	Averaging Period	National Ambient Air QualityStandards(NAAQS)	
		Primary	**Secondary**
Sulfur Dioxide (SO2)	Annual Arithmetic Mean	0.03 ppm (80 ug/m3)	N/A
	24 hour average	0.14 ppm (365 ug/m3)	N/A
	3 hour average	N/A	0.50 ppm (1300 ug/m3)
Lead (Pb)	Quarterly average	1.5 ug/m3	Same as Primary

Units of measure:
ug/mg3 – Micrograms per cubic meter of air.
ppm – Parts per million by volume.
mg/m3 – Milligrams per cubic meter of air.

****** - The ozone 8 hour standard and the PM-2.5 as of this date, April 15th, 2001, are provided as information only. Implementation of these new standards is still awaiting resolution of the Supreme Courts ruling.

Carbon monoxide as a product of combustion is rapidly diluted at short distances from a fire and therefore poses little or no health risk to the general public.

All alternatives have some potential to impact visibility. The smoke sensitive receptors with the greatest potential for impact are the primary state highways in the projects area. Based on the designated speed for primary state highways in the Analysis Area, and using the Forest Service Handbook 7709.56, a safe stopping distance will require a minimum sight distance of 300-500 feet. If the mitigation identified in the mitigation section of this document for air quality is implemented, the proposed project will meet visibility concerns for all action alternatives.

There are activities, such as prescribed fires, which can produce some of the precursors to ozone such as oxides of nitrogen and organic carbon. For the proposed prescribed burns, the levels are estimated to be low enough that they will not contribute to the development of ozone levels above the NAAQS (Sandberg and Dost, 1990).

Based on the distance and the direction from the proposed project, visibility will not be impacted at Mingo National Wildlife Refuge and Wilderness Area. Based on analysis, literature review and implementation of the identified mitigation measures, all NAAQS will be met for the proposed project.

Under state rule 10CSR 10-3.030,4 (c.7), which deals with open burning in Missouri, the USDA Forest Service is exempt. Because the proposed activities are in an attainment area, the conformity requirement will be met. No further conformity analysis is needed at this time. Thus, the proposed project would in compliance with all federal, state and local regulations relating to air quality as well as with the Forest Plan.

Alternatives 1-2: The following direct effects will be similar for all action alternatives, the difference will be in the number of prescribed burns acres to reduce fuel loading as well as prepare areas for natural regeneration or ecosystem restoration.
-Increases in particulate matter and carbon monoxide concentrations.
-Eye, nose and throat irritations.

-Decreased visibility along travel ways (land, water and air).
-Odor/nuisance of smoke.

Alternative 3: This alternative could result in large wildland fires since there would be no management activities to reduce fuel loading of standing and fallen trees. In the action alternatives varying amounts of these fuels will be treated either by removal (harvests) or reduction (prescribed fire). Direct effects will be similar to those for the action alternatives described below, but at higher concentrations and uncontrollable levels.

Smoke from uncontrolled fires has the potential to last for several days. If climatic conditions change quickly, some travel ways, such as Missouri State Highways 67 and 72, may experience decreases in visibility. These impacts can be mitigated for controlled burns, so there will be little or no impact (see mitigation section). Under this alternative, once the wildland fire begins, local, county and state law enforcement would be notified that there is a safety hazard. Implementation of the mitigation actions would not occur until after the fire started.

In general the public, with the exception of the very ill, very young, and the elderly, have a low risk of long-term chronic health impacts, such as asthma, pulmonary disease or other respiratory diseases from prescribed burns (Sandburg and Dost, 1990). This is due in part to the short exposure times, typically 15 hours or less, at concentrations that are below the NAAQS.

Based on the proposed burning times, the nuisance of smoke should be short-term, less than 10 hours.

Indirect effects for all alternatives will be similar; the amount will vary based upon acres burned and whether fires are controlled or wild. Development of ozone precursors from the combustion process.
Decrease in potential of exceeding NAAQS due to a decrease in fuels for wild fires.

The amount of ozone precursors produced is small enough that they will not produce ozone levels that will exceed NAAQS (Sandburg and Dost, 1990). The decrease in NAAQS will be applicable to all alternatives except the No Action. Here there would be an increase in the potential of exceeding NAAQS, specifically PM-10 and 2.5. Decreasing the amount of fuel loading is one way to decrease the potential for NAAQS being exceeded by a wildland fire.

AIR QUALITY - CUMULATIVE EFFECTS

For air quality, cumulative effects include reasonable and foreseeable activities that produce pollutants within the six counties of the Analysis Area. This includes, but is not limited to activities such as operation of combustion engines (i.e. vehicles, lawn mowers, turbines etc.), use of fireplaces, dust from un-paved roads, wildland fires, industrial emissions and so on. These emissions coupled with prescribed burning, may have the potential to exceed the NAAQS for ozone and PM-2.5. Based on the growth of these other activities that produce pollutants, the proposed project will be implemented before they reach a level that would cause NAAQS to be exceeded.

VISUAL RESOURCES - OVERVIEW

The Mark Twain Land and Resource Management Plan establishes Visual Quality Objectives (VQO) for each management prescription. The VQO for a specific area is determined by relating the variety class and distance zone/sensitivity level mapped for each

district to the visual quality matrix found in the standards and guidelines (2300) for each management prescription.

The East Fredericktown Project area is primarily in the Variety Class B- Common. Several compartments in the northern section are in Variety Class A- Distinctive. A few stands in Compartments 530 and 531 in the southeast corner are in Variety Class C- Minimal. The project area is all within the Management Prescription 4.1, LRMP pg. IV-125.

The overall objective for the 4.1-12 area is to emphasize management of shortleaf pine in its natural range on sites where it is recognized as a dominant or characteristic member of the natural community. It provides for economically efficient production of shortleaf pine timber products, dispersed recreation opportunities featuring a roaded natural recreation environment, and production of other resources such as hardwood timber products, recreation, forage, fish and wildlife, and minerals, and satisfies the management requirements of 36 CFR 219.27. The compartments fall within the Oak-Pine Hills and Oak-Pine Breaks Land Type Associations.

This area has rolling, rocky topography with sinkholes and springs. The vegetation and wildlife diversity is typical for this area. Large overstory deciduous trees and pines as well as young trees and openings are interspersed in this project area. The road surfaces are blacktop and gravel, with an average low travel speed.

RECREATION RESOURCES - EXISTING CONDITION

According to OOHA (Ouachita-Ozark Highlands Assessment), approximately 58 million people (21 percent of the U.S. population) live within a 1-day drive of outdoor recreation opportunities in the Ozark-Ouachita Highlands. In 1996, travel expenditures in the Assessment area counties of Arkansas and Missouri totaled over $9 billion and accounted for nearly 167,000 jobs. Public lands, by providing many of the settings for outdoor recreation, are important to maintaining and enhancing a strong tourism industry. Private lands that dominate the forested landscape and influence scenic quality in a large part of the Highlands are also important to the region's tourism industry. State and national parks, national forests, national wildlife refuges, and U.S. Army Corps of Engineer lands and waters account for 13 percent of the Highlands' area and provide the principal settings for many kinds of outdoor recreational activities that are based on natural resources. The three national forests provide recreation opportunities principally in roaded-natural (75 percent) and semi-primitive (20 percent) settings, accounting for 6 percent of the area's campsites. The private sector provides 12 percent, States provide 30 percent, and the U.S. Army Corps of Engineers provide 51 percent. Sixty-three percent of the trail miles in the assessment area are located on national forests. There are 283,012 acres of federally designated wilderness in the Highlands that represent 5 percent of the land area managed by the Forest Service, USDI. Park Service, and the U.S. Fish and Wildlife Service. Wilderness accounts for 4.4 percent of all national forest lands. Approximately 523 miles of rivers in the Highlands have received federal designations based on their exceptional scenic and recreational value. Residents of the Highlands' "draw area" exceed the national average in percent of population participating in every major category of outdoor recreation available in the Highlands. More than 90 percent of the draw area population participates in activities associated with viewing and learning about nature and human history, such as sightseeing, bird watching, and visiting historic sites. Approximately 40 percent participate in fishing, 41 percent participate in outdoor adventure activities (such as hiking or off-road driving), about 35 percent participate in boating, 31 percent participate in camping, and 14 percent

participate in hunting.

The East Fredericktown Analysis Area has a recreation emphasis for Roaded Natural in Management Prescription 4.1.

> Within the **Roaded Natural** setting, the area is characterized by predominantly natural or natural-appearing environments with moderate evidences of the sights and sounds of humans. Such evidences usually harmonize with the natural environment. Interaction with users may be low to moderate, but with evidence of other users present. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design facilities. Equal probability exists to experience contact with other user groups and for isolation from sights and sounds of humans. Opportunity exists to have a high degree of interaction with the natural environment. Challenge and risk opportunities associated with more primitive types of recreation are not prevalent. Practice and testing of outdoor skills is possible. Opportunities for both motorized and non-motorized forms of recreation are available. (Forest Plan Appendix G, pages 1, 2 and 3) The area is managed in such a way that minimum on-site controls and restrictions may be present but are subtle. Motorized use is permitted but restricted.

There are no developed recreation areas within the Analysis Area. Dispersed Recreation opportunities and uses in this area are similar to those found in many areas across the Fredericktown Ranger District. Most general recreation use in the Analysis Area occurs during the fall firearms deer season, when several dispersed campsites are occupied, and the spring and fall turkey seasons. Unauthorized OHV use, both ATV's and motorcycle, has greatly increased in the area recently, primarily on old unclassified roads in the Bidwell Creek vicinity in the northern part of the project area. There is also considerable horseback use occurring in the Pine Union area east of Marquand in the southeast portion of the project area. Wade fishing is popular on Castor River which traverses the area from north to south, but little of the river bottom is in public ownership. Otherwise, recreation use of the area is low to moderate.

Traversing the Bidwell Creek portion of the project area is the John J. Audubon Trail. This 12 mile loop trail is operated by the St. Louis Council of the Boy Scouts. The Boy Scouts reported 64 scouts hiked the trail in the year 2000. A one-half mile section of the trail is proposed for rerouting as part of this project in order to relocate out of the Bidwell Creek Bottom. Both hiking and horseback riding are permitted. Motorized use of the trail, primarily ATV's and motorcycles, has been an increasing problem.

State Highways A, F, T and WW are the only paved roads that run immediately adjacent to NFSL but there are numerous well maintained county roads traversing the area. These, along with forest system roads such as FR 2199 offer opportunities for viewing fall colors or wildlife throughout the area.

RECREATION RESOURCES - DIRECT AND INDIRECT EFFECTS

Alternative 3: The project area would continue to provide opportunities for dispersed recreation, driving for pleasure, and both consumptive and non-consumptive wildlife uses. In the absence of vegetation management, the quality of deer and turkey hunting (and consequently the amount of hunting-season camping), and berry picking opportunities may be somewhat reduced after a period of time. Firewood gathering opportunities may increase as declining black and scarlet oak die and fall to the ground.

As more trees in the red oak group are affected by oak decline, potential safety hazards would increase. Though few accidents have been reported in the last two years there have been instances of trees falling in campgrounds, blocking trails, trees falling across roads and limbs falling near people while recreating in the forest.

Overall, this alternative would still provide recreation opportunities. People could continue to use all the Forest Roads within the project area. There would be increased costs to maintain roads beyond regularly scheduled maintenance, remove hazard trees from along roads. The one half mile section of the Audubon Trail would not be relocated out of the Bidwell Creek bottom.

Habitat diversity resulting from harvesting or prescribed burning would not occur under this alternative, and consequently, opportunities to observe species associated with these habitats would likely not be as great. Conversely, the opportunity to view forest interior species would likely be greater under this alternative than under Alternatives 1-2.

Alternatives 1 (Mechanical) and 2 (Modified Proposed Action): In Alternative 2, logging activities and skidding operations would create intermittent noise and could reduce the enjoyment recreationists get from experiencing the natural environment. The actual impact of the noise depends on the time of day, time of year, and proximity of the recreation user to the harvest operation. The highest risk of recreationists encountering noise would occur during the fall firearm seasons for deer and turkey as hunters are camping, walking and hunting in the project area during these times. The noise impact would be limited to chainsaws under Alternative 1. Fuel wood cutting activities, a form of recreation to some people, would be made available following commercial timber sales.

Under Alternative 2, recreationists could also encounter traffic and adverse road conditions during logging operations that could increase the risk of accidents. The traffic problem would be mitigated by the use of signs to warn recreationists of logging traffic in the area. The road surfaces would be improved (thru an appraisal allowance for reconstruction) or repaired using money (road maintenance deposits) collected from the timber purchaser.

These alternatives would provide roaded natural recreation opportunities as per Management Area 4.1 Forest Plan direction; most system roads would accommodate passenger car traffic although several roads would likely be more suitable for pick-up truck travel.

In the short term, timber harvesting (Alternative 2), mechanical treatments (Alternative 1) and other management activities would cause temporary disturbance or displacement of dispersed hunting and camping opportunities due to unattractive conditions, disturbance of wildlife, and slash on the ground making walking difficult.

The Audubon Trail is adjacent to or dissects the following stands proposed for treatment:

Compartment	Stand	Treatment*	Proximity
576	1	Burn	Dissects
576	3	Burn	Dissects
576	5	Thin/Burn	Adjacent
576	6	ST/Burn	Adjacent
576	10	Burn	Dissects
576	16	CTR	Dissects

Compartment	Stand	Treatment*	Proximity
576	17	CTR	Adjacent
585	10	SW	Adjacent
585	12	SW	Dissects
585	21	SAN	Adjacent
585	30	SAN	Adjacent
588	10	Burn	Dissects
588	14	ST	Adjacent
588	15	SAN	Dissects
588	20	Burn	Adjacent
588	25	Burn	Adjacent
588	26	Burn	Dissects
588	38	Burn	Dissects
589	2	Burn	Dissects
589	8	Burn	Dissects
589	12	Burn	Adjacent
589	14	SAN/Burn	Adjacent
589	18	Burn	Dissects
589	19	SW/Burn	Adjacent
589	20	SW	Adjacent
589	21	Burn	Adjacent
589	30	Burn	Adjacent
589	37	Burn	Dissects

*See Alternative treatment table and veg section for a description of treatments

Vegetation management would have some short-term negative effect on the trail due to the appearance of disturbed vegetation; however, heavy retention along the trail, log-landing location, and slash treatment would help mitigate this effect. Long term, visuals along the burn portions would be improved as the understory is reduced by burning, improving sight distance. The prescribed burning of stands would cause a temporary "blackened" appearance for several weeks until vegetation sprouts or reseeds creating a green vegetative appearance. Some might not like the appearance. However, as burning effects begin to show (more grass growth and wildflowers) these areas should become more attractive for viewing and improve site distance among the trees.

Several stands are proposed for harvest that are dissected by unauthorized OHV trails. Every opportunity will be taken to fill those trails with logging slash in order to discourage their use.

Miles of system road in the project area will be reduced from 33.8 to 33.5 under Alternative 2. (2.7 miles of non-system added and 3.0 miles decommissioned) Reconstruction will be accomplished on 8.3 miles. These improvements will improve access to the area for recreationists. The road system would remain unchanged under Alternatives 1 and 3.

The long term, improved stand vigor, wildlife habitat, and road conditions would result in improved recreation opportunities. Hunting opportunities would likely be enhanced in the vicinity of the harvested or mechanically treated areas due to temporary concentration of game species, and improved visual conditions and accessibility. However, the hunting experience may be less enjoyable or productive for some hunters due to increased encounters with other

hunters and/or wildlife disturbance resulting from increased access. Berry picking would also likely benefit from the increase in temporary openings.

The opportunity to view species associated with early successional habitat would be greatest under Alternatives 1 and 2 due to the amount of regeneration cutting. Conversely, the opportunity to view forest-interior species would be reduced. Hunting for game animals associated with temporary openings and edge would be enhanced.

RECREATION RESOURCES - CUMULATIVE EFFECTS

The Analysis Area caters to dispersed uses such as hunting, hiking, horseback riding, sightseeing and gathering of forest products (firewood, berries and mushrooms). The amount of recreation use has been stable and is in harmony with past management practices, which have included various silvicultural harvests, prescribed fire and follow up reforestation work. Old logging slash from these past activities decays in a few years and is no longer noticeable to the casual forest user. The proposed actions (with mitigation measures as appropriate) are considered to be consistent with the ROS recreation objectives for each of the 4.1 Management. The cumulative effect of any of the action alternatives would have minimal effects on the overall recreation setting and the potential recreation use pattern into the future.

A moderate pattern for dispersed recreation use has been fairly constant over the past 20 years and is not expected to change significantly. It is anticipated that there would be additional management activities in the reasonably foreseeable future in the Analysis Area. It is anticipated impacts experienced would be expected to be similar to those described in the direct and indirect effects portion for recreation in this document. There has been some harvesting completed on private lands in the vicinity consisting mainly of removing sawtimber size trees, thinnings and land clearing. There are other in-holdings that have not recently been harvested or are reverting to overgrown fields. Many of the private lands will blend in with the government lands and are located in the major valleys as open land or pasture. The bottomlands were cleared and lend a semi-pastoral setting to the general area in conjunction with the forested slopes. It's been in this condition since white man moved into the area and will remain this way in the foreseeable future.

The combined effects of past actions, the proposed action and its alternatives, and action in the reasonably foreseeable future on the project areas and lands immediately adjacent are not substantial. The only effects would be to increase the quality of recreation opportunities in the future though there may be short-term negative impacts while management activities are being conducted.

VISUAL RESOURCES - EXISTING CONDITION

The East Fredericktown Project area has a Visual Quality Objective (VQO) of Partial Retention (PR) to Maximum Modification (MM) except for the area adjacent to the Audubon trail which is Retention (R). These areas are associated with the seen area from sensitive travelways or specific use areas. Management activities such as timber harvest must be subordinate to the characteristic landscape. The general appearance is that of a natural appearing forest with some evidence of previous activities including timber harvest.

"In areas having a Visual Quality Objective of Retention and Partial Retention, the

negative visual impacts will be mitigated concurrently with or immediately after each phase or activity. Mitigating measures will be completed for each cutting unit or project area before beginning activities in the next sequential block or project area in the same corridor/viewshed. The total lapsed time from initiation of activities to completion of obligations specified by a contract or a project prescription shall not exceed one year for any single cutting unit or project area. Emphasis will be placed on completing all work within these areas in a systematic manner within the shortest practical time.

In areas having a Visual Quality Objective of Modification, the standards are the same as above except the total lapsed time from initiation of activities to completion of obligations specified by a contract or a project prescription shall not exceed two years for any sale block or project area." (Ref page IV-31 LRMP)

The Audubon trail is a Sensitivity Level 1 travelway with a VQO of Retention (R) in the near foreground (0' up to a maximum 300'). The residue treatment height for retention based on the travel speed of the trail is 18" (See table MTNF LRMP IV-34)

The majority of the area is in the Variety Class B-Common based on the Visual Management System Map for the area with a VQO of Maximum Modification. A general discussion of visual management and effects of the different types of management activities can be found in the National Forest Landscape Management Volume 2, Chapter 1-The Visual Management System Forest Service-US Department of Agriculture-Agriculture Handbook Number 462 (the Big Eye book), incorporated here by reference.

Activity is spread throughout the project area. The residue height is determined by a table using travel speed, VQO, and Sensitivity Level. (See table MTNF LRMP IV-34) The slash disposal height requirements mitigate the negative impact of the activity and shorten the length of time the slash remains visible.

VISUAL RESOURCES - DIRECT AND INDIRECT EFFECTS

In assessing the visual characteristics of the East Fredericktown Project Area it is advantageous to do so in the context of the area in total. Yet in doing so, where site specific attention is warranted, it will be noted by compartment and stand.

All proposed actions have been reviewed by the Forest Landscape Architect through field visits and/or map review and would meet the established VQO unless specifically noted otherwise in the following discussion.

Alternative 1:

Harvests or mechanical treatment would cause a reduction in number of trees per acre, create additional slash on the ground, and require temporary roads or landings that would be visible from Forest Service roads. The effects of harvest on visual values adjacent to these roads would be minor and stay within the VQO for that area. Thinning and removing the overstory would allow the remaining trees to grow larger. Opening up the understory would give the forest user an opportunity to see into the woods from the roadway at a great distance and provide an opportunity to see wildlife and varying plant material.

The burning would reduce woody fuels, encourage grasses and forbs and open the understory of weeds and brush creating a more park like appearance. This alternative would provide for visual variety. The immediate effects of the proposed burning activity would be visible only until the plants grow in the spring.

This alternative would have management activity visible primarily along Sensitivity Level 3 travelways, intermittently spaced along the road, with stretches of no activity visible. Some activity would be seen from Sensitivity Level 2 travelways in Variety Class-B. There is no activity proposed near a Sensitivity Level 1 travelway. (See descriptions of mitigating measures below).

Alternative 2:

This alternative would show more management activity than Alternative #1. It would have almost most twice as many acres of timber treatments that would improve the look of some of the stands giving them a more open, park like appearance with larger diameter trees. This allows the forest visitor a better opportunity to view wildlife, spring flowering and fall colors. The old growth designation would stay the same. 37 miles of road reconstruction and maintenance would improve access for visitors to the area. Relocating a portion of the Audubon Trail and constructing 2 trailheads would improve access for the visitor and improve the trail by moving it out of the floodplain and protect the resource. The rehabilitation of an Artesian well and surrounding area and creation of interpretive signing would enhance the public use of the site and protect the resource. Prescribed burning would be nearly the same as Alternative #1.

Alternative 3: No Action

No changes from the existing condition would be expected to occur. Barring natural disturbance, it is anticipated that the existing visual condition of the project area would be relatively maintained. The project area as a whole would appear as a natural mature or old growth forest in the near future. There would be less visual variety.

Under all the alternatives, there would continue to be open woods and fields due to natural low soil fertility, natural disturbance (windstorm, insect & disease, etc.) or wildfire.

VISUAL RESOURCES - CUMULATIVE EFFECTS

The scope of cumulative effects on visual resources is limited to the area from which the proposed and past treatment areas can be seen. Evidence of previous management practices is visible from some of the roads. Private land management, including cattle grazing, timber cutting, and conversion of woods to pasture can also be seen near the project area. Because theses past activities are visually evident, the proposed actions would not change the overall character of the landscape.

All alternatives would meet the assigned visual quality objectives of partial retention to maximum modification for the project area due to seen area and mitigation. The use of site-specific mitigations measures that follow Forest Plan standard and guidelines as described for the alternatives would aid in meeting those objectives. The cumulative effects of past cutting, the proposed treatments, and activities in the reasonably foreseeable future would result in a forest area that is natural appearing.

Private land uses are likely to remain much the same as in the past 10 years. Much of the private land is farmland and is interspersed throughout the project area. There are dwellings and outbuildings on the private land and varying farm and timber practices.

In all of the alternatives, several things would remain the same. The highways & roads would continue to exist, but may be altered, improved or relocated. Natural disturbances, such as windstorm, ice storms, frosts, insects/disease would continue to affect the project area. Fire protection would continue because it is a policy of the Forest Service to protect resources from wildfire, and because the proximity of private lands & dwellings makes it imperative. The local economy would continue to rely on wood products - which would be removed from private lands as well as other public lands.

Hiking, trail riding, hunting, fishing, trapping and other recreational pursuits would continue.

All options will follow the standards and guides set forth in the Land and Resource Management Plan. There will be no long term negative impacts on any of the recreation opportunities for this area. In fact, over time, this activity will improve the quality and quantity for most dispersed activities such as hunting, wildflower and wildlife viewing and the uses at dispersed sites.

It is important to consider the overall end result desired while at the same time maintaining the current Forest Plan direction.

Prescribed burning would cause a temporary decrease in attractiveness while the area is black. Immediately after prescribed burning, the ground in the prescribed burn area would appear blackened and black fire scars would be visible on the trunks of some of the trees. If done in the spring, within 2-3 weeks new vegetation would begin growing and reduce the black appearance of the burn units. Because the burn is planned to encourage understory herbaceous plants and discourage woody species, the long-term effect will make the area more open to view.

The continued presence of open areas with a carpet of native grasses & wildflowers along the roadsides will provide a break from the wooded corridor. Where management units adjoin private properties that are open fields, the edges will be feathered into the stand. The cut areas will be laid out on the ground in a manner that will reflect natural lines and be visually subordinate to the characteristic landscape.

Under all the alternatives, there would continue to be open woods due to natural low soil fertility, natural disturbance (windstorm, insect & disease, etc.) or wildfire. Most existing roads would continue to be maintained.

Alternatives 1 & 2 would allow for regeneration of the maturing and declining stands and identify the areas of old growth to maintain. Open woods (an overstory of medium to large size trees with few midstory trees and abundant ground cover of grasses and forbs) would be recreated and maintained through a combination of activities. The areas along travelways and private land would contain open and forested sections on both sides of the roads, providing for visual variety.

Alternative 3 would mean that only natural disturbances would occur. All communities present would continue to exist, although the amount of each community type might fluctuate over time. Fire protection would keep wildfires to a minimum, so it is unlikely that fire would be a factor. The oak-pine communities would continue to mature and decline, with many small openings created by natural mortality of individual trees and some larger openings created by windstorm, ice damage, insect, disease, or other disturbance. A large percent of the area would soon be in mature and old growth successional stages with only a small amount of early to mid successional stages. Roads would still exist and be used.

HERITAGE RESOURCES - EXISTING CONDITION

The environment of the Missouri Ozarks has changed substantially over the last 12,000 years. Following 4,000 BP, the modern Oak-Hickory-Shortleaf pine forest developed and the area took on the appearance that lasted through the early historic period. Humans have inhabited the Ozarks for at least 13,000 years. The prehistoric cultural sequence defined for Missouri contains four general periods: Paleoindian, Archaic, Woodland, and Late Prehistoric (Chapman 1975; 1980; O'Brien and Wood 1998; Wettstaed 2000b; Wettstaed and Harpole 2002). The St. Francis Mountains are rather poorly known compared to a number of other areas in the Ozarks. The earliest Native American inhabitants of the region were big game hunters who lived a highly mobile

lifestyle. The Late Archaic Period (5,000-2,600 BP) marked the first appearance of domesticated plants (cultigens) in the Midwest. Sites dating to this time are much more common and there appears to have been a more intensive and extensive use of the region by Late Archaic people. The settlement pattern consisted of base camps scattered widely through the area and a number of temporary campsites. Numerous small limited use or procurement/processing sites are found. Locally available chert, frequently obtained from river gravel, was the primary raw material used for producing stone tools. The Late Prehistoric Period is when the bow and arrow first appeared and maize begins to show up in the archaeological record of the Midwest, although only in small quantities. There is little change from the Archaic Period adaptation, with the exception of the addition of such traits as ceramics and burial in rock mounds. No sites dating after 600 BP have been found in the northern Ozarks. The area appears to have been completely abandoned for unknown reasons. During early Historic times, the Osage Indians claimed all of the Ozark Highlands, but by AD 1800 they were limited largely to southwestern Missouri (Reeder 1988:53).

Much less research has been devoted to the Historic Period sequence, with relevant discussions being those of Flanders (1979; n.d.), Price and Price (1981), Price et al. (1991), Rafferty (1980), Smith (1992), and Wettstaed (1995; 2003). Euroamerican settlement of the Ozarks began in the late seventeenth and early eighteenth centuries. The numbers of people involved were small until the nineteenth century, but following the Louisiana Purchase by the United States, settlement of the Ozarks rapidly increased compared to the earlier periods. Most of the early settlers in the Ozarks were of Scotch-Irish descent from Tennessee and Kentucky who carried a distinct culture based on self-sufficient maintenance agriculture, with the family as the basic unit of labor. Widely scattered farms were the primary type of settlement, with only a few towns. The years following the Civil War were a period of change and upheaval in the Ozarks, yet they also showed a continuity of the cultural patterns seen earlier. Very few towns existed in the Ozarks prior to the Civil War, but by 1890 there were numerous settlements scattered along the railroads. Population in the state jumped by 45% between 1860 and 1870. Eventually, the timber and railroad boom came to an end. When the trees were cut and the mines closed, companies moved on and abandoned the rail lines. Many of the workers, however, stayed behind and tried to make a living from subsistence farming. Much of the cut over land was sold off by the big companies as small farms to these remaining workers. The frequency of archaeological sites greatly increases during the post-Civil War period. A majority of the archaeological sites in the region probably date to the late 19th and early 20th centuries. They represent sites associated with the logging and mining industries, as well as subsistence farms. The boom years that began following the Civil War did not last, dieing out between 1910 and 1920. All of the merchantable timber in the Ozarks had been cut, few resources were left in the region, and severe erosion began to occur on the denuded hillsides. Wildlife disappeared and farming declined with the removal of the thin ridge-top soils. Many of the workers who came during the lumber boom had developed an attachment to the communities and stayed behind when the jobs left. Poverty became a serious problem. Change came again to the Ozarks during this period, sparked once more by outsiders, primarily the United States government, beginning with the New Deal programs in the 1930's and continuing with the presence of federal land holding agencies such as the U.S. Forest Service, Park Service, and Corps of Engineers (Rafferty 1980:139, 172, 185).

Following Euroamerican settlement in the early 19th century, substantial environmental changes once again occurred in the region. At first, the bottomland forests were cleared for agriculture, while logging of the uplands soon followed

(Wood and O'Brien 1995:35). From the late 19th through early 20th centuries, logging on a massive scale occurred throughout the Ozarks, resulting in almost complete deforestation of the region. After all the merchantable timber was cut, the lands owned by the iron and lumber companies were sold off as farms. Farming proved to be marginal at best in most of these areas and the farmlands were converted to rangeland. The result of all of this activity was a devastated resource base. Soil erosion became a major problem, springs went dry, and wildlife essentially disappeared (Rafferty 1980:185-186). The present forest environment seen in the Ozarks today has developed entirely since the 1930s and the establishment of conservation and forest management in Missouri. Present forest types in many cases differ from those found in pre-settlement times. In many cases the forests seen in the Ozarks today are much different than those that existed 150 years ago.

HERITAGE RESOURCES - DIRECT AND INDIRECT EFFECTS

Surveys have been conducted to locate heritage resource sites in all of the areas proposed for activities that may damage such resources. In consultation with the Missouri State Historic Preservation Office (documented in the current Memorandum of Understanding between the MTNF and the State Historic Preservation Office), the follwing activities have been determined to not affect heritage resources: TSI in previously harvested stands, over-story removal in previously harvested stands, prescribed burning in previously burned stands, and pre-commercial thinning where hand-cutting methods are employed and the cut trees are left in place.

The surveys that have been conducted within the project area have recorded a total of 45 heritage sites, including 27 prehistoric sites, 13 historic sites, and five sites with both prehistoric and historic occupations. Of these 45 sites, 12 are located within or adjacent to stands which are proposed for treatment in one or more of the alternatives (Table HR 1). Because site locational information is protected from public disclosure per the provisions of 36 CFR 296.18, these sites are are identified in the present document only to the compartment level in Table HR1.

Several of the proposed activities have the potential to damage heritage resource sites. In general, these effects can be separated into two broad categories—effects resulting from ground disturbing activities resulting from timber harvest and road construction and/or reconstruction and effects associated with prescribed burning activities. In the following sections the potential direct and indirect effects of the proposed project will be discussed according to these categories.

Direct effects to heritage resources as a result of timber harvest and road construction and/or reconstruction activities result from the disturbance of the ground surface. Archaeological sites in the Ozarks are typically fairly shallow. It is quite common for cultural deposits to be found no deper than 30-40 cm, and at many prehistoric sites several thousand years of occupation may be present in a mere 30 cm of deposition. Historic period sites tend to be even shallower, with most deposits on the MTNF typically being no deeper than 10 cm. In addition, at historic sites there are often low surface features, such as rock foundations, that could also be easily disturbed.

As a result being so shallow, archaeological sites in the Ozarks can be severly impacted by activities that disturb the ground surface. Such effects have been documented in several reports, including the following activities: skidding logs (Wettstaed 1999); establishing log landings (Wettstaed 1999; 2000a); the use of bull dozers, skidders and other heavy equipment (Gallagher 1978; Wettstaed 2001); and driving over a site in wet conditions so that deep ruts are created. An overview of the various types of impacts to

archaeological sites can be found in Wildesen (1983).

Extensive research has been conducted in the western United States regarding the effects of fire on archaeological sites (Connor and Cannon 1991; Jones and Euler 1986; Lissoway and Propper 1990; Noxon and Marcus 1983; Picha et al. 1991; Sayler et al. 1989; Traylor et al. 1983; Wettstaed 1993). In the eastern woodlands, however, little or no research on fire effects has been conducted. The following assessment is based on a review of the available literature, the results of post-burn monitoring on the Ava/Cassville/Willow Springs Ranger District of the Mark Twain National Forest (Price 1998; 2001), and the professional experience of the Shared Service Archaeologist on numerous wild and prescribed fires. Without implementation of protective measures prior to the burn, archaeological sites may be directly affected by prescribed burning in the following ways:

Sites Along Firelines:

Archaeological sites, both historic and prehistoric, may suffer damage to both above ground and subsurface archaeological deposits, features, and artifacts, as a result of construction of firelines by heavy equipment. Generally, construction of firelines by hand (using leaf blowers and leaf rakes) will not damage archaeological sites and artifacts.

Sites with aboveground combustible elements:

Historic sites that have wooden and other combustible elements (artifacts or the remnants of cultural features constructed of wood or other combustible materials) are subject to adverse effects from burning without implementation of protective measures prior to the burn because such elements are likely to be destroyed by the burn.

Sites with aboveground features containing stone, concrete, and mortar:

Historic or prehistoric sites that contain stone features and concrete and mortar may be subject to adverse effects from burning without implementation of protective measures. A concentration of fuels that may burn at very high temperatures around such stone and concrete features could damage the features. If fuel buildup and heat intensity is great enough stone, concrete, and mortar may be thermally altered and/or may exfoliate from the intense heat. Rock art, if present, can be damaged by the thermal alteration or exfoliation of the rock upon which it is present.

Sites with exposed surface artifacts:

In the same way that above-ground features containing stone, concrete, and mortar may be damaged from excessive heat from fuel buildup on the features, so to may artifacts made of stone, glass, and ceramics suffer damage (through heat alteration, melting, and exfoliation) from intense and very hot fires. Fuel buildup on the sites in open areas with exposed artifacts may then result in adverse effects on these sites.

With respect to heat damage, unless there is a concentration or buildup of fuels on the archaeological sites it is not expected that the fire will burn hot enough to adversely affect any of the sites that do not contain aboveground combustible elements (Wettstaed 1993). Temperatures achieved by grass fires and woods fires with low fuel buildup are not high enough to cause heat alteration, exfoliation, or other damage to stone, concrete, mortar, or artifacts. It is expected that prescribed burning in these situations will have little, if any, effect on prehistoric lithic materials and on foundations and other non-combustible features and artifacts associated with historic sites. Those archaeological sites most at risk of harm from the prescribed burning are those located along firelines, those containing aboveground

combustible materials, and those with above-ground features on which fuels have become concentrated. Archaeological sites that are not in these situations are not expected to be at risk for adverse effects from the prescribed burning.

Indirect effects are those effects that may occur after the project has been completed, but which can be considered to be a result of project implementation. In the case of timber harvest and road construction activities, the most likely indirect effects to heritage resources include erosion of the cultural deposits and the increase of public accessibility to the sites. If the mitigation measures proposed in this document are followed, there will be no erosion to cultural deposits and there will be no indirect effects to heritage resources from erosion.

In regards to increased access to sites, studies (Ahlstrom et al. 1992) have shown that the frequency of the vandalism and unauthorized excavation of archaeological sites can be influenced by accessibility. The more accessible a site is, the more likely it is to be subjected to vanadalism and unauthorized excavation. Such occurrances are a documented problem on the MTNF (Price 1999; Wettstaed 1998).

The most likely indirect effects on heritage resources as a result of prescribed burning are the following:

Erosion:

Archaeological sites located on slopes that are denuded of vegetation during the burn may be subject to damage from erosion following the burn depending on the extent of the denuding and the timing of revegetation after the burn.

Recreational Use:

Archaeological sites may be at risk of harm from recreational use of the area following the burn in two ways.

Use of Firelines as Trails:
At times, after burns have been completed, the firelines are used by horseback riders, mountain bikes, and by ATV and other off-road vehicle operators. Although such use may be unauthorized, the open firelines nevertheless do provide what is essentially a system of trails for Forest visitors. Even though protected from damage during fireline construction, archaeological sites located along these firelines may subsequently be damaged by post-burn use of the lines by motorized vehicles.

Exposure of Artifacts on the Surface:
Artifacts exposed on the surfaces of the open firelines and open ground in the burn interior may be at an increased risk for unauthorized collection by Forest users following the burn, depending on the nature and extent of recreational use of the burn area.

If all mitigation measures discussed elsewhere in this document are followed, there will be no indirect effects to heritage resource sites from the proposed prescribed burns.
Regardless of which action alternative is chosen, there will be no negative indirect effects to heritage resources.

Alternative 3 has no potential to directly affect heritage resource sites. In regards to indirect effects, there would be no change from the present condition and as a result there will be no indirect effects to heritage resources.

Prescribed Burning Effects Common to Alternatives 1 and 2: Of the 12 sites determined to potentially be affected by the proposed activities, seven are present in areas being considered for prescribed burning (Table HR1). These include both prehistoric and historic period sites. At the present time, it is anticipated that none of these sites will be affected by prescribed burning. There will be no direct effects to heritage resources from prescribed burning under these alternatives.To ensure that this is the case, as well as to provide data to evaluate the potential effects of future

projects, these sites will be monitored by an archaeologist following burning to determine if there were any affects to the sites.

Although archaeological sites may be indirectly affected in adverse ways following a prescribed burn, in the case of these proposed prescribed burns, it is not expected that archaeological sites will be at increased risk for damage from indirect effects for the following reasons:
1) Existing Forest roads that will be used as firelines already see horseback, ATV, and other off-road vehicle use, and this use is not expected to increase as a result of the burn. The sites that might be located along the roads, therefore, are not expected to be at increased risk of harm from future use of these roads (as compared to present risk).

2) The mechanically constructed sections of fireline that may become trails following the burn will be routed so as to avoid the archaeological sites. There will be no increased use of these existing trails as a result of the burn.

3) Ground cover is expected to return relatively quickly after the burn, thus limiting any risk to the archaeological sites in the burn unit of increased exposure to unauthorized collecting and to damage from slope erosion.

Therefore, adhering to the mitigation measures will result in no indirect effects to heritage resources under these alternatives.

Timber Harvest Effects Common to Alternatives 1 and 2: Of the two action alternatives, Alternative 2 hase the greatest potential to negatively affect heritage resources because the greatest number of sites (N=5) are present in areas proposed for ground disturbing activities (HR 1). Adhering to the mitigation measures will result in no direct effects to heritage resources under these alternatives. Four of these sites will be avoided and protected from all project activities. Avoidance of cultural resources will be understood to require the retention of such properties in place and their protection from effects resulting from the undertaking (Memorandum of Understanding between the Mark Twain National Forest and the Missouri State Historic Preservation Officer, June, 1995). Effects will be avoided by: (1) rerouting around sites those roads for which reconstruction is proposed; and (2) establishing buffer zones around those sites in areas where harvest activities will take place. Roads will by-pass sites at a sufficient distance and buffer zones will be of sufficient size to ensure that the integrity of the characteristics and values that contribute, or may contribute, to the properties' significance will not be affected. Site avoidance is the preferred mitigation action pursuant to the Forest Plan, Section IV-30, 31 (also FSM 2361.21[2]).

The fifth site FS site #09-05-02-1291, represents the remains of an historic roadbed that may date to the early nineteenth century and may have been used by the Cherokee on the Trail of Tears. In several places, the roadbed is fairly deeply incised, but is currently unused. The historical integrity of the site has not been determined, but the Forest will preserve the integrity of the roadbed as it now exists. As part of the proposed timber harvest activity, it will be necessary to haul timber across the roadbed. At the time the timber sale is sold, the archaeologist and sale administrator will visit the site and identify the best location to affect this crossing. The area will be photographed and mapped prior to hauling timber across the roadbed, and the archaeologist will monitor this use during and after the sale and document this monitoring in a report to the SHPO. If these mitigation measures are followed, it is the Forest's opinion that this undertaking will have No Adverse Effect on FS site #09-05-02-1291.

In regards to indirect effects to heritage sites as a result of increased access, it is anticipated that the accessibility of any sites likely to be vandalized will not be increased by this project. No new roads will be constructed in these alternatives.

HERITAGE RESOURCES - CUMULATIVE EFFECTS:

The laws and regulations pertaining to heritage resources are site specific in that the effects being considered are evaluated in regards to their effect on each particular heritage site. An adverse effect is considered to have occurred to a heritage site when the characteristics that may make that site eligible for inclusion on the National Register of Historic Places have been altered (36 CFR 800.5[a][b]). Therefore, cumulative effects to heritage resources are considered to be the incremental effects of past, present, and reasonably foreseeable future actions on each specific heritage site. In the case of the proposed burn, these cumulative effects would consist of the combined outcome of the various potential direct and indirect effects discussed above, along with any effects from past and future activities in the project area. Past activities that have occurred in the area include mining, farming and land clearing for agriculture, timber harvest, and road and trail construction. At the present time, the anticipated future use of the area consists primarily of recreation use of trails by hikers, horses, and mountain bikes. None of the alternatives considered would affect heritage resource sites. Therefore, there would be no cumulative effects to heritage resource sites as a result of the proposed project regardless of the alternative selected.

Monitoring: As noted in Table HR 1 and discussed above seven sites located within the area proposed for prescribed burns will be visited by an archaeologist following the burns and monitored for any damage that may occur. FS site #09-05-02-1291 will be monitored during and folowing project implimentation. The results of this monitoring will be presented in a monitoring report(s) that will be submitted to the State Historic Preservation Officer. This monitoring report(s) will then be used to guide mitigation measures to be used on future projects.

HR1. Heritage Resource Sites Potentially Requiring Protective Measures.

Comp	Site #	Age[1]	Type	Alt. 1[3]	Alt. 2	Alt. 3	Mitigation[4]
531	02-1281	H	Farmstead	H	H	-	Avoid
541	02-564	H	Farmstead	B	B	-	Monitor - PB
564	02-1290	H	Unknown function	H	H	-	Avoid
564	02-1291	H	Historic road	-	R	-	Avoid, Monitor - I
576	02-1104	B	Prehistoric campsite, sawmill	B	B	-	Monitor
582	02-1282	P	Prehistoric campsite	-	H, R	-	Avoid
588	02-1309	H	Sawmill?	B	B	-	Monitor - PB
589	02-1301	B	Prehistoric campsite, Unknown function	B	B	-	Monitor - PB
589	02-1303	B	Prehistoric campsite, farmstead	B	B	-	Monitor - PB
589	02-1304	B	Prehistoric campsite, farmstead	B	B	-	Monitor - PB
589	02-1306	B	Prehistoric campsite, farmstead	B	B	-	Monitor - PB
590	02-1283	H	CCC Lookout Tower	-	H	-	Avoid

1 – H=Historic Period; P=Prehistoric Period; B=Both Prehistoric and Historic Period.
2 – NRHP = Eligibility for National Register of Historic Places: N=Not Eligible; Y=Eligible; ?=Eligibility Undetermined.
3 – Activity occurring that may potentially disturb the site: H=Timber Harvest Activities; B=Burning; R=Road Construction.
4 – Recommended mitigation measures to protect the site:
Avoid=Site will be buffered and protected from ground disturbing activities.
Monitor - PB=Conduct post-burn monitoring to ensure sites were not affected by burning.
Monitor - I=Conduct monitoring during implementation to ensure site not damaged.

TRANSPORTATION SYSTEM - EXISTING CONDITION

The East Fredericktown project area is within the 4.14, 4.15, 4.16, and 4.17 management areas. There are 23 Forest Service system roads within the management areas, with a combined length of 33.8 miles. The project area contains 17,657 acres or 27.5 square miles of National Forest System land. This equates to 1.2 miles of system road per square mile of Forest Service land. The Forest Plan, page IV-131, provides direction on the maximum density of system roads allowed within a 4.1 MA, which is 2-mile/square mile of Forest Service land. The road density for the project area is below the Forest Plan's maximum density limit.

Missouri State highway 72, along with secondary state highways A, BB, DD, F, HH, J, M, NN, O, T, V, W, and WW in Bollinger, Madison, Perry, and St. Francois counties provide primary access to the East Fredericktown project area. Within the project area are county, Forest Service and private roads. National Forest system roads within the project area vary from 0.2 miles to over 11 miles in length. Most county and constructed Forest roads within the project area have an aggregate surface. The East Fredericktown project has 8.3 miles of system roads that need reconstruction before they can be used to access project activities.

In addition to system roads, there are non-system roads on National Forest System land in the project area. Some have been in place since the early 1900's, when the entire area was first logged. Many of these roads have been used repeatedly since this early logging period for timber harvesting and recreational pursuits. Some were inherited through land purchase or acquisition. The condition of these roads is usually fair to poor because no road improvement or maintenance work has ever been done. Those located on ridge tops are relatively stable, except for areas that become soft when wet. Those located on side slopes or in riparian areas are less stable and may become entrenched, rutted, or washed out. Regardless of their origin, the Forest Plan on page IV-85 gives direction that all roads under Forest Service jurisdiction "not shown on the Transportation Plan, or its subsequent revisions, shall be closed unless under special use permit". Some of the non-system roads have been closed by the District or have become inaccessible due to natural vegetation growing up, but many have remained open because of continued recreational vehicle use. Other non-system roads are under special use permit to allow access to private property.

All roads that are open, including both system and non-system, receive some degree of vehicular traffic. Use occurs primarily on weekends for recreational driving, hunting, firewood gathering and other recreational pursuits. A majority of non-system roads within the project area are used frequently by

ATVs. Horseback riders also use the roads for recreational pursuits.

TRANSPORTATION SYSTEM - DIRECT AND INDIRECT EFFECTS

The Forest Plan, pages IV 81-85, identifies the general forest-wide management direction for roads; including construction, reconstruction, maintenance, closure and obliteration. The need for road construction, reconstruction, improvement or maintenance is based on proposed management activities, management area objectives, and the need for resource protection. The intent of road construction or reconstruction is to provide long-term access into an area with the least amount of disturbance possible. Part of the "least disturbance" objective is to ensure resource damage does not occur in the future after a road has been constructed or reconstructed. Seasonal restrictions, access closures and proper construction will minimize disturbance to the area. Road construction or reconstruction increases the degree of soil and vegetative disturbance in the short term while providing long term load bearing strength and stabilization of the surrounding soil and vegetation. Roads are constructed or reconstructed to provide the minimum standard of road necessary for management area objectives. Road reconstruction will reduce seasonal access restrictions due to wet weather. Road improvement and maintenance are preventive measures and are used to stabilize an existing road, protect road investments, and minimize disturbance to surrounding resources.

Alternatives

Alternative 3 (No Action):

No changes would be made to the existing 33.8 miles of system roads within the project area. Current road conditions would be maintained. No roads would be reconstructed. Non-system roads within the project area would remain open. No temporary roads would be created. The management area's road density would remain at 1.2-miles/square mile. Public access to the area would remain unchanged. There would be no evident change in environmental effects, except that system roads, which need to be reconstructed, would continue to deteriorate if not eventually reconstructed.

Alternative 2*:*

Current road conditions for 22.5 miles of system road would be maintained. Reconstruction of 8.3 miles of system road would be required to access project activities. Forest Roads 2021 (0.6 mile), 2135 (0.8 miles), 2137A (0.6 mile), 2148 (2.5 miles), 2160 (0.7 mile), 2176 (0.6 mile), 2177 (0.8 mile), 2177A (0.3), 2190 (1.2 miles) and 2197 (0.2 mile) will need to be reconstructed to remove infringing brush, correct drainage problems, and provide a stabile road surface by applying crushed aggregate base. In addition, 2.7 miles of non-system road would be converted to system road and reconstructed. Forest Roads 2134A (0.2 mile), 2139 (0.6 mile), 2164 (0.5 mile), 2170A (0.3 mile), 2176 (0.5 mile), 2180A (0.5), and 2197 (0.4 mile) would be decommissioned, for a total of 3.0 miles.

There are approximately 50 miles of non-system roads within the project area. Currently, 1.9 miles of non-system road are under special use permit in the project area. Additional non-system roads have been identified as possible candidates for special use permits. Non-system roads, except for those converted to National Forest system roads or those under special use permit, would be decommissioned. Approximately 40 miles of non-system road would be decommissioned.

Alternative 1:

Would be the same as Alternative 3.

TRANSPORTATION SYSTEM - CUMULATIVE EFFECTS

The road density for each of the alternatives would be 1.2-miles/square mile, which is less than the 2-mile/square mile allowed in the Forest Plan for MA 4.1. Past transportation system activities, the proposed action, and the potential activities in the reasonably foreseeable future do not pose any appreciable cumulative effects on access to or use of the project area or its vicinity for each of the alternatives.

ENVIRONMENTAL JUSTICE

Area Residents

According to 2000 Census data, 97,312 people reside in Bollinger, Madison, Ste Genevieve, and St. Francois counties which cover the East Fredericktown Project Area. The data in Table 23 summarizes the general characteristics of this population group.

2000 Census data (Table E-1)

The Ozark Ouachita Highlands Assessment (OOHA) found that thirty-seven counties in the Assessment area experience "persistent poverty". The racial and ethnic composition of the Assessment area changed little between 1970 and 1990, remaining predominately white (91 percent). Overall, educational levels are relatively low in the assessment area. In non-metropolitan counties in 1990, 37 percent of adults 25 years and older had not completed high school (or its equivalent), and 13 percent of teenagers (age 16 to 19) were high school dropouts. OOHA area workers, especially those living in the non-metropolitan counties with national forest lands, face higher unemployment rates than the nation as a whole. Workers living in non-metropolitan counties with Mark Twain National Forest lands face the highest incidence of full-time, but seasonal work. The overall level of socioeconomic well-being in the OOHA area is relatively low. Median household incomes in the area were $19,208 in 1989, compared to $20,832 in Missouri, and $30,057 in the nation.

Poverty levels for counties in the project area are: Bollinger County, 20.3%, Madison County, 23.9%, Ste. Genevieve, 14.3%, and St, Francois County, 21.7. The minority population for the counties in the project area is less than 1%. Missouri consists of 12.2% below the poverty level and 15% minority. Based on the 2000 U.S. Census information, minority population in the East Fredericktown Project Area is less than that of the State of Missouri. The poverty level is higher than the rest of the state.

The proposed action and alternatives do not pose a disproportionately high and adverse environmental, human health, economic or social effect on the counties. The location of the East Fredericktown Project Area was not chosen to adversely affect any group or segment of the population. This finding is based on the effects contained in other portions of the Environmental Effects Section.

Table E-1. Census Data

		Bollinger	Madison	Ste. Genevieve	St. Francois
Total Population	97,312	12,029	11,800	17,842	55,641
Gender	Male	5,950	5,656	8,975	28,276
	Female	6,079	6,144	8,867	27,365
Ethnic Group	White	11,763	11,599	17,491	53,494
	Black	25	15	128	1,126
	American Indian/Alaska Native	87	30	53	196
	Other	16	24	23	127
Age	0-19 years	3,459	3,201	5,226	14,933
	20-64 years	6,790	6,479	10,024	32,390
	65+ years	1,780	2,120	2,592	8,318
Education Level	High School Diploma				
	College Degree				
Median Income	(1999 Data)	$30,462	$25,601	$39,200	$31,199
Employment 2002	Professional and Technical	31	71	65	273
	Retail	336	519	506	2,843
	Transportation/Mfg	262	634	1,778	2,741
	Farming/Forestry/Fishing	19	17	36	97

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT ON RESOURCES

None of the alternatives would have an irreversible or irretrievable commitment on this resource in the proposed East Fredericktown Project Area. Effects on Consumers, Civil Rights, Minority Groups and Women

Forest Service activities must be conducted in a discrimination free atmosphere. Contract work that may be generated from this document would include specific clauses offering civil rights protection. The Forest Service would make a concerted effort to enforce these policies. Executive Order 12898 of February 11, 1994, Environmental Justice as part of the National Environmental Policy Act (NEPA), calls for consideration of the environmental, health, and economic effects on minority and low-income areas including the consumption patterns for fish and wildlife. The East Fredericktown Project Area would have limited direct, indirect, or cumulative effects on minorities and low-income populations.

SUMMARY OF IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT ON RESOURCES

None of the alternatives would have an irreversible or irretrievable commitment to any resource in the proposed East Fredericktown Project Area. The Mark Twain National Forest LRMP FEIS (page II-125), states: "Utilization of a renewable resource is not considered irretrievable as long as its renewal is not prevented."

ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF ALTERNATIVES

The scope of all the alternatives, are limited to the size of the geographic area and the extent of any of the planned activities. Therefore, the energy required to implement any alternatives (Alternative 3 would still require energy usage for fire suppression activities) would be insignificant based on local, regional and national energy use. The alternatives would offer little or no opportunity for energy conservation in the local area. The Forest Plan FEIS also discusses energy use on page IV-45.

REQUIRED FEDERAL PERMITS AND LICENSES

Federal permits are not required for this project.

OTHER REQUIRED DISCLOSURES

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

NEPA requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

CUMULATIVE EFFECTS

Cumulative effects are addressed in the environmental consequences 'topics' discussion.

CHAPTER 4. CONSULTATION AND COORDINATION

Preparers and Contributors

The Forest Service consulted the following individuals, Federal, State, and local agencies, tribes and non-Forest Service persons during the development of this environmental assessment:

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Missouri Depart of Natural Resources

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CHAPTER 5 INDEX

CHAPTER 6 GLOSSARY

A

activity
Actions, measures, or treatments that are undertaken which directly or indirectly produce, enhance, or maintain forest and rangeland outputs or achieve administrative or environmental quality objectives, such as recreation.

affected environment
The natural and physical environment and the relationship of people to that environment that will or may be changed by actions proposed.

air quality related values (AQRV's)
A feature or property of an area that is (or has the potential to be) affected in some way by air pollution. General categories are: flora, fauna, soil, water cultural/historical resources, odor and visibility.

alternative
In Forest Planning, a mix of practices applied in specific amounts, locations, and periods to achieve future forest conditions through the application of management prescriptions.

ambient air
The air of the surrounding outdoor environment. The air encompassing a specific geographic area.

Analysis Area
Similar features in combination that reflects the basic land characteristics and existing conditions. These features are combined for the purpose of analysis in formulating alternatives and monitoring results.

Analysis Area identifier
An Analysis Area identifier is a name for up to six levels that categorize land and age of existing vegetation. Each identifier helps divide the landscape into units that have different treatment needs, treatment responses, production capabilities, management costs, and relevance to problem statements.

aquatic
Aquatic pertains to standing and running water in streams, rivers, lakes, and reservoirs.

aquifer
An underground geological formation or group of formations that contain water, a source of ground water for wells and springs.

aquitard
A layer of low permeability that can store ground water and also transit it slowly from one aquifer to another.

arterial roads
Roads that provide service to large land areas and usually connect with public highways or other Forest arterial roads. They are usually long-term constant service roads.

aspect
The compass direction that the slope of a land surface faces toward.

attainment area
A geographic area in which levels of a criteria air pollutant **meets** the health-based primary standard (national ambient air quality standard, or NAAQS) for the pollutant. An area may have on acceptable level for one criteria air pollutant, but may have unacceptable levels for others. Thus, an area could be both attainment and non-attainment at the same time. Attainment areas are defined using federal pollutant limits set by EPA. There are six Criteria Pollutants; Lead (Pb), Sulfur Dioxide (SOx), Nitrogen Oxides (NOx), Ozone (O3), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO) which are regulated by EPA. A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.

Available water holding capacity
The maximum amount of water a soil profile can hold, which can be used by plants.

B

BAE
Biological Assessment/Evaluation

basal area
The cross section area of a tree stem near the base, generally at breast height and inclusive of bark.

benefit (value)
Inclusive terms used to quantify the results of a proposed activity, project or program expressed in monetary or non-monetary terms.

BE
Biological Evaluation (see BAE)

Biological diversity
The variety and complexity of species present and interacting in an ecosystem and the relative abundance of each.

buffer zone
A zone of fixed width (100 feet in Forest Plan) in which activities are modified to meet specific objectives of an adjoining site.

C

canopy

The vegetative cover formed collectively by the crowns of adjacent trees and other woody growth.

canopy cover
The percentage of ground or water covered by a vertical projection of the outermost perimeter of the natural spread of foliage or plants. Small openings within the canopy are included. Total canopy coverage may exceed 100% due to layering of different vegetative strata.

capability
The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity.

Carbon sequestration
Carbon sequestration in terrestrial ecosystems can be defined as the net removal of CO2 from the atmosphere into long-lived pools of carbon. The pools can be living, aboveground plants, products with a long, useful life created from plants such as lumber, living biomass in soils such as plant roots or micro-organisms or other carbon compounds in soils and deeper environments. Increasing photosynthetic carbon fixation alone is not enough. This carbon must be fixed into long-lived pools such as trees or lumber. Otherwise, one may be simply altering the size of changes in the carbon cycle, not increasing carbon sequestration. (Department of Energy)

cavity trees
Trees exhibiting hollows large enough to provide s I helter for wildlife usage.

characteristic landscape
The local natural appearing landscape within a scene or sequence of scenes being viewed. The visual impression created by combinations of landscape features perceived in terms of form, line, color, and texture.

characteristic type
An area of land that has common distinguishing visual characteristics of landform, rock formations, water forms, vegetative patterns, and cultural effects. It is used as frame of reference to classify physical features of an area as to their scenic quality. Two character types have been identified and utilized on the Forest, the Dissected Till Plains and Ozark Plateau.

Class I Area
A geographic area designated for the most stringent degree of protection from future degradation of air quality. The Clean Air Act designates as mandatory Class I areas each National Park over 6,000 acres and each Wilderness over 5,000 acres in existence as of August 7, 1977. Subsequent additions of land to those Class I areas are also considered Class I.

Class II Area
A geographic area designated for a moderate degree of protection from future degradation of air quality. Moderate increases in new pollution may be permitted in Class II areas. All wildernesses designated after August 7, 1977 or were less than 5,000 acres are automatically Class II areas, as are all other National Forest System lands.

closed-canopy
Complete or nearly complete, 100% canopy cover.

compaction
In soil, the process by which soil particles are rearranged to decrease void space and bring them in closer contact with each other, thereby reducing available water capacity, aeration, and porosity and increasing bulk density.

Cowbird parasitism
The act of brown-headed cowbirds laying their eggs in the nests of other birds. The cowbird does not rear its own chicks but lays eggs in the nest of other birds. Cowbird chicks often hatch earlier and grow faster outcompeting the resident chicks. Those birds hardest hit by parasitism are the neotropical migratory songbirds of the forest interior.

corridor
A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries (36 CFR 219.3).

Corridor view shed
The total landscape seen or potentially seen from all or a local part of a travel way, use area, or water body.

criteria air pollutants
a group of very common air pollutants regulated by EPA on the basis of criteria (information on health and/or environmental effects of pollution). Criteria air pollutants are widely distributed all over the country.

crown closure
See canopy cover. Refers to amount of forest canopy that does not contain any large openings.

cultural resource
The physical remains (artifacts, ruins, burial mounds, petroglyphs, etc.) or conceptual context (as a setting for historic, or prehistoric events, etc.) of an area that gives insight into the lives of earlier man.

cultural resource area
An area containing authentic, significant, and interesting buildings, sites, architecture, memorials, or objects having scientific, historic, or social values.

cutting cycle
For a stand, the planned, recurring time between successive cuttings.

D

dbh
Diameter breast height of a tree measured 4-1/2 feet above ground level.

decommissioned
remove from active service

developed recreation

Recreation that requires facilities that result in concentrated use of an area. Examples are campgrounds and ski areas. Facilities might include: roads, parking lots, picnic tables, toilets, drinking water, ski lifts, and buildings.

developed recreation site
A distinctly defined area where facilities are developed to serve concentrated public use, e.g., campgrounds, picnic areas, and swimming areas.

DFC
Desired Future Condition

displacement
In soils, often used interchangeably with erosion. Detachment and movement of soil particles by water, wind, ice, or gravity and can be natural, human caused or both.

Distance Zones
Areas of land divided into near foreground, foreground, middle ground and background that represent relative distance from viewers located on travel way, in use areas, or on water bodies.

diversity
The distribution and abundance of different plant and animal communities and species within the area covered by a land and resource management plan.

dolomite
A limestone or marble rich in magnesium carbonate.

duff –
The more or less firm organic layer on top of mineral soil, consisting of fallen vegetative matter in the process of decomposition, including everything from pure humus below to the litter on the surface.

E

early successional
describes a species adapted to the beginning stages of biotic succession, i.e., a species that does best in open areas and full sun.

ecological classification system (ECS)
A systematic procedure for delineating, naming, and describing units of land with management significance and ecological integrity. It includes a terrestrial and an aquatic subsystem.

ecological landtype (ELT)
An area of land with a distinct combination of natural, physical, chemical, and biological properties that cause it to respond in a predictable and relatively uniform manner to the application of given management practices. In a relatively undisturbed state and/or at a given stage (sere) of plant succession, an ELT is usually occupied by a predictable and relatively uniform plant community. Typical size generally ranges from about ten to a few hundred acres.

Ectomycorrhizal

Symbiotic association between the stringlike mass of fungi and the roots of certain plants. This stringlike mass (called mycelium) forms a mantle on the surface of the roots and extends into the surrounding soil and inward between the root cells. This association enables the roots to take up nutrients and moisture into the plant which might otherwise be unavailable to it.

edge effect
the tendency of wildlife to use the areas where two vegetative types come together forming an edge; where rabbits, for example, concentrate in an area where brush land and meadow land meet because of the diversity of food, shelter, and other habitat components provided by the edge.

effect (impact), economic
The change, positive or negative, in economic conditions, including the distribution and stability of employment and income in affected local, regional, and national economies, which directly or indirectly result from an activity, project, or program.

effects (impact), physical, biological
The change, positive or negative, in the physical or biological conditions which directly or indirectly results from an activity, project, or program.

effect (impact), social
The changes, positive or negative, in social and cultural conditions which directly or indirectly result from an activity, project, or program.

efficiency, economic
The usefulness of inputs (costs) to produce outputs (benefits) and effects when all costs and benefits that can be identified and valued are included in the computations. Economic efficiency is usually measured using present
net value, though use of benefit-cost ratios and rates-of-return may sometimes be appropriate.

endangered species (E)
Any species that is in danger of extinction throughout all or a significant portion of its range. The appropriate secretary must designate it in the Federal Register.

environmental analysis
An analysis of alternative actions and their predictable short and long term environmental effects which include physical, biological, economic, and social factors. The process associated with the preparation of an environmental assessment or environmental impact statement, environmental assessment (EA) A public document that serves to (1) briefly provide sufficient analysis and evidence for determining whether to prepare an environmental impact statement or a finding of no significant impact and (2) aid in agency's compliance with the NEPA when no environmental impact statement is necessary (40 CFR 1598.9a).

environmental effect
Net change (good or bad) in the physical, biological, social, or economic components of the environment resulting from human actions.

environment impact statement (EIS)

A statement of environmental effects required for major Federal actions under Section 102 of the National Environmental Policy Act of 1969 (NEPA), and released to the public and other agencies for comment and review. It is a formal document that must follow the requirements of NEPA, the Council on Environmental Quality guidelines, and directives of the agency.

ephemeral stream
A stream or portion of a stream that carries only surface runoff and hence flow occurs during and immediately after periods of precipitation or melting of accumulated snow. They have no permanent or well-defined
channels but follow slight depressions in the natural contour of the ground surface. The drainage basin is either impervious or the groundwater table is always below the bed of the ephemeral stream.

even-aged silvicultural system (EAM)
See silvicultural system, even-aged.

even-flow
Continuous supply of products over a given time period.

F

fecal coliform

A bacteria that is present in the intestines or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water and are characterized as gram-negative, rod-shaped bacteria that ferment lactose with gas formation.

fen
seepage areas characterized by soils saturated with groundwater that wells up from the substrate through relatively thick layers of mucky soil high in organic material. Often found in open areas with little or no shade, except on margins, and dominated by sedges, small trees and shrubs.

final harvest
See regeneration harvest.

fire ecology
The study of the effects of natural and anthropogenic fire on ecosystems, plants and animals, and its application/role in carrying out resource management objectives.

fire hazard
A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree both of ease of ignition and of fire suppression difficulty.

floodplain
Lowland and relatively flat areas adjoining inland and coastal water including flood-prone areas of off-shore islands, including as a minimum, that area subject to a one percent or greater chance of flooding in any given year. The base floodplain shall be used to designate the 100-year floodplain (one percent chance floodplain). The critical action floodplain is defined as the 500-year floodplain (0.2 percent chance floodplain).

forbs
Any herbaceous plant other than those in the Gramineae (or Poaceae), Cyperaceae, and Juncaceae families.

Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA)
An act of Congress requiring the preparation every five years of a program for the management of the National Forests, renewable resources and every 10 years an inventory of all National forest and rangeland resources.

forest interior conditions

conditions found deep within forests, away from the effect of open areas. Forest interior conditions include particular microclimates found within large forested areas.

forest land
Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use.

Forest Plan
A shortened name for Land and Resource Management Plan.

Forest Service Handbook (FSH)
Handbooks are directives that provide detailed instructions on how to proceed with a specialized phase of a program or activity. Handbooks are usually based on a part of the manual or incorporate external directives.

Forest Service Manual (FSM)
The manual contains legal authorities, objectives, policies, responsibilities, delegations, and instructions needed on a continuing basis by Forest Service line officers and primary staff in more than one unit to plan and execute assigned programs and activities.

Forest Supervisor
The official responsible for administering a National Forest. The Forest Supervisor reports to the Regional Forester.

forest type
A descriptive term used to group stands of similar character or development and species composition, by which they may be differentiated from other groups of stands.

Fragipan
Loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt and fine sand. A fragipan appears cemented and restricts roots. When dry, it is very hard and has as higher bulk density than the horizons above. When wet, it tends to rupture suddenly under pressure rather than to deform slowly.

fragmentation

the process of transforming large continuous forest patches into one or more smaller patches surrounded by disturbed areas. This occurs naturally through such agents as fire, landslides, windthrow and insect attack. In managed forests timber harvesting and related activities have been the dominant disturbance agents.

fuels
Wildland vegetative materials that can burn. While usually referring to above ground living and dead wildland surface vegetation, roots and organic soils such as peat are often included.

G

game species
Any species of wildlife or fish for which seasons and bag limits have been prescribed under state or federal laws, codes, and regulations.

glade
A predominantly open area developed over thin, droughty soils and supporting primarily prairie-type vegetation with eastern red cedar prevalent.

H

habitat
The place where animals live. It can be water for beaver, fish, and aquatic insects; caves for bats; or forested areas for many mammals, birds, and reptiles.

hard mast
the fruit or nuts of trees such as oaks, beech, walnut, chinquapin, and hickories.

hardwood
A broad-leaved flowering tree that drops its leaves annually, as distinguished-from a conifer.

horizontal diversity
The distribution and abundance of different plant and animal communities across a specified'-area of land.

I

implementation
Forest Plan implementation is the action necessary to ensure uniform accomplishment of the Forest and Regional management direction. 36 CFR 219.10(e).

indicator species
A species whose presence in a certain location or situation at a given population indicates a particular environmental condition. Their 'population changes are believed to indicate effects of management practices on a number of other species or water quality.

integrated resource management

A management strategy that emphasizes no resource element to the exclusion or violation of the minimum legal standards of others.

Interdisciplinary Team (IDT)
A group representing several disciplines used for regional and forest planning to insure coordinated planning of the various resources. Through interactions among its members, knowledge of the physical, biological, economic and social sciences, and the environmental design arts shall be integrated in the planning process.

intermediate harvest
Any removal of trees from an even-age stand between the time of its formation and the regeneration cutting.

intermittent stream
A stream or portion of a stream, which in general, flows during wet seasons and are dry during dry seasons. The groundwater table lies above the bed of the stream during the wet season but drops below the streambed during dry seasons. Hence, the flow is derived principally from surface runoff, but during wet seasons receives a contribution from groundwater.

K

karst landform
Terrain with distinctive characteristics of relief and drainage arising primarily from a higher degree of rock solubility in natural waters than is found elsewhere. Some of these characteristics are dry streams, underground drainage, eaves, and sinks.

L

land acquisition
The purchase of full land ownership rights.

Land and Resource Management Plan (Forest Plan)
A plan of management for a National Forest developed in accord with the principles set out in 36 CFR 219.1 and the planning process set out in 36 CFR 219.12 and which will provide for multiple use and sustained yield of goods and services in a way that maximizes long term net public benefits in an environmentally sound manner.

landtype association (LTA)
These are recurring areas of land approximately 5,000 to 100,000 acres, fairly uniform in land surface form, subsurface geological materials, patterns of soils, and potential natural vegetation. Each LTA exhibits a unique pattern of ecological landtypes (ELTs). It is a subdivision of a physiographic subsection.

late forest succession
A stage of forest succession where the majority of trees are mature or over mature.

legume

An herb, shrub, or tree of the family Leguminous bearing nodules on the roots that contains nitrogen-fixing bacteria.

local roads
Roads that connect terminal facilities with Forest collector or Forest arterial roads. They are usually long-term roads that are placed in intermittent service after the resource activity is completed.

Loess
Material transported and deposited by wind and consisting of predominantly silt sized particles.

losing stream
A stream that distributes 30% or more of its flow, through natural processes, such as through permeable subsoil or cavernous bedrock, into groundwater.

M

management area (MA)
An area that has direction to achieve a common goal throughout. The entire Forest is divided into management areas; each is given a description, and the policies and management prescriptions relating to their use are listed with them.

management prescription (MP)
Management practices and intensities selected and scheduled for application on a specific area to attain multiple use and other goals and objectives. 36 CFR 219.3.

Mark Twain Ecological Land Classification Terrestrial System (MT ELCTS)
Resource inventory system describing land units by which resource managers can assess capability, suitability, and management opportunities for various Forest areas. It serves as a useful reference for land management planning and project implementation.

MIS
Management Indicator Species

MOFWIS
Missouri Fish and Wildlife Information System

monitoring and evaluation
The periodic evaluation, on a sample basis, of management practices to determine how well Forest Plan objectives have been met and how closely management standards have been applied.

mortality
death or destruction of forest trees as a result of competition, disease, insect damage, drought, wind, fire and other factors (excluding harvesting).

MP
Management Prescription

MTNF

Mark Twain National Forest

multiple use
The management of all the various natural resources of the National Forest so that they are utilized in the combination that will best meet **the needs** of the American people; making the most judicious use of the land for some or all of these resources or related services over areas large enough to provide sufficient latitude for periodic adjustments in use to conform to changing needs and conditions; that some lands will be used for less than all resources; and harmonious and coordinated management of the various resources, each with the other, without impairment of the productivity of the land, with consideration given to the relative values of the various resources, and not necessarily the combination of the uses that will give the greatest dollar return or the greatest unit output.

MVP
Minimum Viable Population

N

National Ambient Air Quality Standards (NAAQS)
Legal limits of atmospheric pollution established by the Environmental Protection Agency (EPA), as the concentration limits needed to protect all of the public against adverse effects on public health and welfare, with an adequate safety margin. Primary standards are those related to health effects; secondary standards are designed to protect the public welfare from effects such as visibility reduction, soiling, material damage and nuisances. There are six criteria pollutants; Lead (Pb), Sulfur Dioxide (SOx), Nitrogen Oxides (NOx), Ozone (O3), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO). A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.

National Environmental Policy Act of 1969 (NEPA)
An act to declare a national policy which will encourage productive and enjoyable harmony between man and his environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality.

National Forest Management Act of 1976 (NFMA)
A law passed as an amendment to the Forest and Rangeland Renewable Resources Planning Act and which requires the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.

National Forest System land NFS)
National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.

National Forest System road (system road)
A road under the jurisdiction of the Forest Service and determined to be needed for long-term motor vehicle access.

National Register of Historic Places
A listing maintained by the U.S.D.I. National Park Service of areas which have been designated as being of historical significance. The Register includes places of local and state significance as well as those of value to the Nation as a whole.

National Wild and Scenic River System
Rivers with outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act.

National Wilderness Preservation System
All lands designated by the Wilderness Act and subsequent wilderness designations, irrespective of the department or agency having jurisdiction.

Native grasses
Grasses that originated in the area in which they are found, i.e., were not introduced and naturally occur in that area.

Natural Area
A physical and biological unit in as near a natural condition as possible that exemplifies typical or unique vegetation and associated biotic, soil, geologic, and aquatic features. The unit is maintained in a natural condition by allowing physical and biological processes to operate, usually without direct human intervention (Backman and Quintas 1972).

Natural History Area
An area composed of natural phenomena that reference the development of the earth's surface and the evolution of life. These are further identified as scenic, geological, botanical, or paleontological areas.

natural regeneration
The reestablishment of a tree cover by natural seed fall, sprouting, or suckering of vegetation on or adjacent to the area.

Neotropical Migrants
The category of migratory birds that spend the winter in Central and South America and return to North America to breed.

nest predation
the act of preying upon eggs or young animals in a nest

noxious weeds
any weed so designated by the Weed Control Regulations and identified on a regional district noxious weed control list.

non-attainment area
A geographic area in which the level of a criteria air pollutant is **higher than** the level allowed by the federal standards. A single geographic area may have acceptable levels of one criteria air pollutant but unacceptable levels of one or more other criteria air pollutants; thus, an area can be both attainment and non-attainment at the same time. It has been estimated that 60% of Americans live in non-attainment areas. The six Criteria Pollutants are; Lead (Pb), Sulfur Dioxide (SOx), Nitrogen Oxides (NOx), Ozone

(O3), Particulate Matter (PM-10 and PM-2.5) and Carbon Monoxide (CO). A seventh pollutant, Volatile Organic Carbons (VOC's) is on the list but is not regulated by EPA at this time.

0

oak decline
A complex natural phenomenon caused by the interaction of predisposing, inciting, and contributing factors, which severely stress and weaken oaks, particularly red oaks, causing crown dieback, reduced radial growth, and mortality. These stress factors are both environmental and biological. Predisposing factors include: red oaks of relatively old age (60-70 years), Droughty soils, and previous severe droughts. Inciting factors include: recent severe droughts and repeated spring frost damage or severe insect defoliation. Contributing factors include *Armillaria* root rot, Two-lined chestnut borer, leaf-eating insects, and the red oak borer.

off-road vehicle
Any motorized vehicle designed for or capable of cross-country travel on or over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (a) any registered motorboat, (b) any fire, military, emergency, or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (c) any vehicle whose use is expressly authorized by the respective agency head under a permit, lease, license, or contract.

Old Growth
stands possessing five major characteristics, as follows: an average age equal to or greater than rotation age for the species of dominant trees in the stand; old growth areas will be at least 15 acres in size with a minimum width in the narrowest portion of 200 feet. Consolidation of stands into 80 to 200 acre areas is preferable. At least 40% stocking of live trees 12 inches or more in diameter breast height on site indexes from 35 to 54. For sites 55 and greater, a 40% stocking of live trees 14 inches or more dbh should exist. In both site index ranges, some trees exceeding the minimum specified dbh by about 50% should exist. Evidence of some large tree decadence such as broken and dead tops and limbs, top and/or bottom rot and cavities. Large standing snags and large logs on the ground throughout the area.

outfitting
The provision of equipment, supplies, livestock, and materials. It includes such outfitting services as rental of boats, horses, tents, and other equipment or gear.

outdoor skills
Skills necessary to recreate in an undeveloped, natural setting comfortably and effectively with minimum risk to oneself or others. For example, reading a map and compass, campfire cooking, tent living, first aid, canoeing, etc.

over-story
That portion of the trees in a forest forming the uppermost canopy.

P

Partial Retention (PR)

A visual quality objective that in general means man's activities may be evident but must remain subordinate to the characteristic landscape.

Passerine
perching birds mostly small and living near the ground with feet having 4 toes arranged to allow for gripping the perch; most are songbirds; hatchlings are helpless

perennial stream
Streams that flow throughout the year in a well defined channel. In such streams the groundwater table never drops below the bed of the stream and therefore maintains a continuous supply.

Physiographic area
a landscape surface created by similar geologic processes.

Poletimber
young trees 5.0 inches to 8.9 inches in diameter for softwood, or 5.0 inches to 10.9 inches in diameter for hardwood trees.

Primary Standard
This is a standard set by the Environmental Protection Agency (EPA) to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly.

PM-10
Particles with an aerodynamic diameter smaller than ten micrometers. Particles this size and smaller have been shown to cause problems with human health and visibility.

PM-2.5
Particles with an aerodynamic diameter of 2.5 micrometers. Particles this size and smaller have been shown to cause problems with human health and visibility.

project
A project is a combination of one or more management practices and associated support activities to meet the intent of the Forest Plan.

Puddling
Act of destroying soil structure, reducing porosity and permeability. Often results from handling soil when it is in a wet, plastic condition so that when it dries it becomes hard and cloddy.

R

Ranger District
Administrative subdivision of a National Forest supervised by a District Ranger who reports to a Forest Supervisor.

Recreation Opportunity Spectrum (ROS)
A system of classifying the range of recreational experiences, opportunities, and settings available on a National Forest. Classifications include: (1) Primitive (P), (2) Semi-primitive Motorized (SPM), (3) Semi-primitive Non-motorized (SPNM), (4) Roaded natural (RN), (5) Rural (R), and (6) Urban (U).

reforestation
All treatments and activities aiding the re-establishment of a tree crop or tree cover on forested land. It includes the preparation of the ground surface prior to natural seed fall, natural sprouting, artificial seeding, or planting. It also includes the setting out of seedlings, cuttings, or transplants, and scattering or placement of seed over a designated area for the re-establishment of a forest stand.

regeneration
the renewal of vegetation by natural or artificial means. A regeneration period can be the period required or allowed in the plan for regenerating trees following timber harvest.

RFSS
Regional Forester Sensitive Species

right-of-way (ROW)
Easement in the lands of others obtained for public access by donation, purchase, or condemnation.

riparian area
A term used by the Forest Service that includes stream channels, lakes, adjacent riparian ecosystem, floodplain, and wetlands.

road
A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail.

road closure
Activities that restrict or limit access of motorized vehicles on roads that are not needed for constant or long-term access. A gate or other method controls the amount and timing of vehicle traffic.

road construction
Activity that results in the creation of a new permanent or temporary road where one did not exist before. Such activity may include clearing the road's right-of-way of impeding vegetation, installing or creating drainage features, adding surface material, and installing traffic control devices.

road decommissioning
Activities that eliminate motorized vehicular travel and which result in the stabilization and restoration of unneeded roads to a more natural state.

Road decommissioning may involve one or more of the following treatments: blocking access with earthen berms, rock berms, boulders, or slash piles; restoration of natural drainage features by removing culverts and recontouring the area; scarification to remove the road bed; revegetation by seeding, planting, or fertilizing; and signing to discourage motorized use of the road.

road density
The measure of the degree to which a length of road occupies a given land area: e.g., one mile of road within a square mile.

road maintenance

The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective. Activities associated with road maintenance may include surface blading, replacement of surface material, mowing and limbing of roadside vegetation, cleaning and restoring drainage features, and replacing traffic control devices.

Road Maintenance Level
All National Forest System roads are assigned a maintenance level. Maintenance level defines the service provided and the maintenance required for the specific road. Factors used to determine a road's maintenance level include, but are not limited to, resource management needs, service life, user safety, volume and type of traffic, surface type, and user comfort and convenience. The following is a very brief description of the road maintenance levels:

1. Maintenance level 1 – Basic custodial care
2. Maintenance level 2 – Suitable for high clearance vehicles
3. Maintenance level 3 – Suitable for passenger cars and generally having an aggregate surface
4. Maintenance level 4 – Suitable for passenger cars and generally having a paved surface that provides a moderate degree of user comfort
5. Maintenance level 5 – Suitable for passenger cars and having a paved surface that provides a high degree of user comfort

road reconstruction
Activity that results in the improvement or realignment of an existing road. Road improvement may increase a road's capacity for traffic or change its original design function. An example of road improvement would be changing the road's surface from aggregate to asphalt. Road realignment results in a new location of a road or a portion of the road and the treatment of the old roadway.

Road effect zone
zone or distance from a road in which wildlife species are directly or indirectly affected by activities occurring on or along the road

Rutting
Soil disturbance where the soil is puddled and the topsoil and/or a portion of the subsoil removed.

S

salvage
The utilization of trees that are dead, dying, or deteriorating before they become worthless.

sanitation
The removal of dead, damaged, or susceptible trees, essentially to prevent the spread of pests or pathogens and so promote forest hygiene.

Savannah
A more or less open, woodland having an undergrowth mainly of grasses, the trees being of moderate height.

Scrub-shrub
Habitat consisting of small or stunted trees and/or shrubs, generally of unmerchantable species.

secondary standard This is a standard set by EPA to protect public welfare, including protection agent decreased visibility, damage to animals, crops, vegetation and buildings.
sensitive species
Species designated by the Regional Forester and included on the Eastern Region Sensitive Species list. The list will include those species identified by criteria below that are known, reported, or suspected to occur on or in the immediate vicinity of the planning area in the Eastern Region. The criteria are:

A. Species is in officially proposed status by Federal Register Proposed Rule making.
B. Species is on a Notice of Review List in the Federal Register (e.g., CFR 45: 242; 12/15/80).
C. Species placed on the Region 9 Sensitive Plant or Animal lists at the discretion of the Regional Forester if he deems that they require special management attention. Examples of situations that may cause such listing include:

    1. Species common elsewhere, but a disjunct population of unique, popular, or scientific interest occurs on National Forest System land.
    2. Locally endemic population in unique habitats that warrant continued monitoring or special management to assure jeopardy is not occurring and will not occur in the future.

silviculture
The science and art of cultivating forest tree crops. The theory and practice of controlling the establishment, composition, constitution, and growth of forests.

site preparation
Preparation of the ground surface before planting, seeding, or in anticipation of natural seed fall, sprouting, or suckering for the re-establishment of the tree crop or tree cover. It includes removal of unwanted vegetation, slash, stumps, and root from a site or the shaping of the ground surface.

skid road
A path traversed by a tractor or skidder in which mineral soil is exposed.

skid trail
A path traversed by a tractor or skidder one or more times in which mineral soil is not intentionally exposed. Machines operate on the litter surface and not on a graded surface.

slash
The vegetative residue left on the ground after felling and other silvicultural operations or accumulating there as a result of storm, fire, girdling, or poisoning.

snags
Dead trees with or without cavities, at least 6 inches in diameter and at least 10 feet in height.

Soft mast
the fruits and berries of dogwood, viburnums, elderberry, huckleberry, spice bush, grape, raspberry, and blackberry

Source-Sink Dynamics

Refers to the ability of a wildlife population to sustain itself over short and long periods. Populations may be considered either "source" populations or "sink" populations. Reproduction in the source population exceeds maintenance levels and the excess reproduction in the source population supplies the populations of the sink areas where net reproduction is generally insufficient to maintain populations. The sink populations are generally found in marginal habitats where resources are generally insufficient to maintain population levels

Soil displacement
The movement of soil particles from one place to another by erosion or management activities and/or those influences which result in the soil structure.

Soil horizons
A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil forming processes and differing in characteristics and properties from the adjacent layers above and below it.

O horizon – Organic layer of fresh and decaying plant residue

A horizon – The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with mineral material. This horizon has the most organic matter accumulation, the most biological activity, and/or loss of soil materials containing iron, aluminum, and clay.

B horizon – Horizon, usually below the O, A, or E horizon, and is, in part, a transition layer from the overlying horizon to the underlying C horizon. It is characteroized by (1) accumulation of clay material, humus, and other material, (2) granular, primatic, or blocky structure, and/ or (3) redder or browner colors than those in the overlying horizon.

C horizon – Mineral horizon, excluding bedrock, that is little affected by soil forming processes and does not have properties found in the overlying horizon.

E horizon – Mineral horizon in which the main feature is loss of clay particles, iron, aluminum, or combination of these.

R horizon – Bedrock underlying the C horizon.

special use permit
Permits, memorandums of understanding, and easements (excluding road permits and highway easements) authorizing the occupancy and use of National Forest land for a specific period of time by individuals, organizations, or businesses generally for a fee.

stand
A community of trees or other vegetation possessing sufficient uniformity as regards composition, constitution, age, spatial arrangement, or condition, to be distinguishable from adjacent communities, so forming a silvicultural or management entity.

Stem Density
refers to the number of woody stems in the forest understory. A high stem density would reflect a forest floor with nearly complete coverage by small trees and shrubs.

Subsoil
Technically, the B horizon.

Subsurface layer
Any surface soil horizon below the surface layer

Surface soil
The A, E, or combinations of those horizons.

standards and guidelines (S&Gs)
Criterion indicating acceptable norms, specifications, or quality that management actions must meet.

T

temporary road
A road authorized by contract, permit, lease, other written authorization or emergency operation not intended to be a part of the Forest transportation system and not necessary for long-term resource management.

terrestrial
Land related.

threatened species (T)
Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and which has been designated in the Federal Register by the Secretary of the Interior as a threatened species.

timber production
The purposeful growing, tending, hat-vesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use.

U

unclassified road
A road on National Forest System lands that is not managed as part of the Forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail, and those roads that were once under permit or authorization and were not decommissioned upon the termination of the authorization. (The current FP refers to them as non-system roads)

under-story
The trees and other woody species growing under a cover of foliage formed collectively by the upper portion of adjacent trees and other woody growth.

unneeded road

A road under the jurisdiction of the Forest Service and determined through a roads analysis not to be needed for long-term motor vehicle access. The road is not authorized by easement, permit, contract, or other written authorization.

V

vertical diversity
The distribution and abundance of different plant and animal communities from the ground level up.

viable population
A population, which has adequate numbers and dispersion of reproductive individuals to ensure the continued existence of the species population on the planning area.

Viburnum Trend
An area of numerous lead and related ores bodies in the vicinity of Viburnum, Missouri. This Trend extends for approximately 30 miles and ranges in width from a few hundred yards to more than two miles. It is the premier lead producing area in the United States.

visual quality objective (VQO)
A desired level of excellence based on physical and sociological characteristics of an area. It refers to degree of acceptable alteration of the characteristic landscape.

W

Wild and Scenic Rivers Act
An Act passed in 1968 which declared that it is a policy of the United States that certain selected rivers of the Nation which, with their immediate environments, possess, outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other values, shall be preserved in free-flowing condition, and that they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations. The Act established a National Wild and Scenic Rivers System. The Eleven Point National Scenic River was one of the original components of the system.

Wilderness
All lands in the National Wilderness Preservation System as designated by Congress.

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CHAPTER 8 APPENDICES

Appendix A
Biological Assessment – U.S. Fish and Wildlife Service Consultation and Sensitive Species Biological Evaluation

Appendix B
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Appendix D
Biological Diversity

Appendix A

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